WATERSHED PLAN
and
ENVIRONMENTAL IMPACT STATEMENT
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UPPER SAN MARCOS RIVER WATERSHED

COMAL AND HAYS COUNTIES, TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

JUL 1978

FINAL

WATERSHED PLAN AND ENVIRONMENTAL IMPACT STATEMENT

UPPER SAN MARCOS RIVER WATERSHED

Comal and Hays Counties, Texas

Prepared under the Authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 USC 1001-1008) and in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 USC 4321 et seq).

Prepared by: Upper San Marcos Watershed Reclamation and Flood Control District
Hays County Commissioners Court
City of San Marcos
Comal-Hays-Guadalupe Soil and Water Conservation District
U.S. Department of Agriculture, Soil Conservation Service

PREFACE

Enclosed are two documents--the Watershed Plan and Environmental Impact Statement for Upper San Marcos River Watershed, Comal and Hays Counties, Texas.

The Watershed Plan has been developed by the local sponsors with the assistance of the U.S. Department of Agriculture and is the basis for the authorization of federal assistance to implement the proposed project in accordance with the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 USC 1001-1008).

The Environmental Impact Statement has been prepared by the U.S. Department of Agriculture in compliance with Section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 USC 4321 *et seq*).

The Environmental Impact Statement contains the detailed information on project area, planned project, problems, impacts, alternatives, etc.

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UPPER SAN MARCOS RIVER WATERSHED PLAN

Comal and Hays Counties, Texas

July 1978

SUMMARY AND DESCRIPTION [1/]

This Watershed Plan (hereinafter referred to as the Plan) for watershed protection and flood prevention for Upper San Marcos River Watershed has been prepared by the Sponsoring Local Organization (hereinafter referred to as Sponsors) which is comprised of the Upper San Marcos Watershed Reclamation and Flood Control District, Hays County Commissioners Court, City of San Marcos, and Comal-Hays-Guadalupe Soil and Water Conservation District (hereinafter referred to as the Reclamation and Flood Control District, the County, the City, and the SWCD, respectively). Technical assistance has been provided by the Soil Conservation Service (hereinafter referred to as SCS), United States Department of Agriculture (USDA). The Fish and Wildlife Service, United States Department of Interior (USDI), in cooperation with the Texas Parks and Wildlife Department, made a reconnaissance study of fish and wildlife resources of the watershed. The Plan has been coordinated with the Texas Historical Commission and the National Park Service, USDI. Archeological surveys of the floodwater retarding structure sites were conducted by the Texas Archeological Survey, The University of Texas at Austin. An environmental assessment of the watershed was prepared by Environmental Sciences of San Marcos. The Department of Landscape Architecture at Texas A&M University prepared a comprehensive water-based recreation and landscape plan, portions of which were incorporated in the Plan.

Financial assistance in developing the Plan was provided by the Reclamation and Flood Control District and the Edwards Underground Water District.

The Upper San Marcos River Watershed comprises a total area of 95 square miles (60,780 acres) in portions of Comal and Hays Counties. It is estimated that 1.2 percent of the watershed is cropland; 2.4 percent is pastureland and hayland; 77.5 percent is rangeland; 17.9 percent is urban and built-up land; 0.1 percent is small water areas; and 0.9 percent is in miscellaneous uses such as the farmsteads, etc.

The principal problem within the watershed is flooding which results in damages to residences, businesses, public buildings, agricultural

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1/ All information and data in this Watershed Plan, except as otherwise noted by reference to source, were collected during watershed planning investigations by the Soil Conservation Service, U.S. Department of Agriculture.

properties, city streets, automobiles, etc. Human lives have been lost from floods. Total floodwater and indirect damages are estimated to average $879,660 annually. There is a need for a water resource improvement and additional public water-based recreational facilities.

Project objectives are: obtain a 90-95 percent reduction in average annual damages to urban property, obtain a 60-75 percent reduction in average annual flood damages to agricultural properties, provide opportunities for public water-based recreation, protect fragile and unique habitats along the San Marcos River, and increase the quality of life for the area as a result of project installation. The project as formulated meets these objectives.

The structural measures in this Plan are five floodwater retarding structures, water resource improvement, and public water-based recreation facilities to be installed within a five-year installation period. The total estimated cost of those measures is $5,911,860, of which the local share is $1,441,320, Public Law 566 share is $4,447,270, and other Federal cost is $23,270. Local share of the cost consists of land rights, specific cost-shared items, and project administration. Other Federal funds are for the cost of archeological mitigation.

Watershed lands will continue to be protected from erosion and sedimentation. The project will reduce flooding on 1,887 acres of flood plain lands within the watershed and will directly benefit 908 residential properties, owners or occupants of 92 business establishments, 23 public buildings, and 17 owners and operators of agricultural land in the flood plain.

Installation and functioning of the five floodwater retarding structures will require 1,489 acres (excluding auxiliary borrow areas) of land. A total of 160 acres of this area will be needed for dams and emergency spillways. Approximately 1,241 acres will be needed for the sediment and retarding pools (at maximum elevation during designed emergency spillway flow). Flowage easements will be obtained on 88 acres below the spillways of Floodwater Retarding Structure Nos. 1, 2, 4, and 5. Auxiliary borrow areas may be required on 36 acres outside the easement line of Floodwater Retarding Structure Nos. 1 and 4.

As planned, 346 acres will be cleared of existing woody vegetation for construction and proper functioning of the five floodwater retarding structures. Upland habitat existing in this area will be destroyed during construction. Wildlife habitat remaining in the sediment and retarding pools will be altered.

Installation of the water resource improvement will better convey storm runoff and protect the immediate surrounding park area from a potential erosion problem. Recreational facilities will be installed along the San Marcos River on portions of 47 acres of parkland owned and operated by the City. The facilities will provide for about 22,430 additional

recreation days of use annually. The recreational experience will be enhanced by improving the visual resources of the San Marcos River.

Average annual damages will be reduced from $879,660 to $27,940 by the proposed project. Average annual damage reduction benefits accruing from five floodwater retarding structures will be $851,720. Average annual benefits accruing from recreational facilities will be $56,300. The ratio of total average annual benefits from five floodwater retarding structures and recreational facilities ($908,020) to the average annual cost of those measures ($410,820) is 2.2 to 1.0. In addition, $6,540 average annual benefits will accrue from external economies within the region.

The County will be responsible for operation and maintenance of the five floodwater retarding structures which is estimated to be $980 annually. The City will be responsible for operation, maintenance, and replacement of the water resource improvement and recreational facilities at an annual cost of $250 and $17,280, respectively.

PLANNED PROJECT

The project will consist of structural measures. Conservation land treatment, however, has been applied under the going program on privately owned lands within the watershed. Therefore, local interests will continue to apply needed conservation land treatment measures on about 9,300 acres which will compliment the planned structural works of improvement and protect watershed lands from erosion and sedimentation. The land users will make the decision on the use of their land and the treatment measures which they will install. The SCS field offices in San Marcos and New Braunfels will assist the Soil and Water Conservation District, under the authority of Public Law 46, in providing land users and operators with technical assistance on conservation land use programs.

Structural measures to be installed include five floodwater retarding structures (Table 3). Each of the floodwater retarding structures will be composed of an earth dam or embankment with a principal spillway and plunge basin, an emergency spillway, a floodwater retarding pool, and a sediment pool. The planned system of structures will detain runoff from 82.3 percent of the watershed. Sediment pools at the lowest ungated outlet will occupy 104 acres. However, none of the sediment pools are expected to retain water for any significant period of time because of high infiltration rates into the Edwards Underground Reservoir. The floodwater detention pools will cover 934 acres when water reaches the elevation of the emergency spillway.

The City will continue to enforce an existing flood plain zoning ordinance. The City and the County will notify annually flood plain landowners and residents of flood hazards. The area subject to flooding is defined in the Environmental Impact Statement. These actions will complement the planned structural works of improvement.

A water resource improvement consisting of two side inlets, earth shaping, and vegetation will be installed along selected areas of the San Marcos River. These measures will protect unique aquatic habitat from human encroachment and a potential erosion problem.

Public water-based recreational facilities will be established along the San Marcos River on portions of 47 acres of parkland owned or controlled by the City. Facilities will include picnic tables, grills, trails, shelters, fishing piers, restrooms, bridges, access roads, and vegetative plantings for screening and wildlife.

The Environmental Impact Statement should be reviewed for pertinent information regarding the planned project, environmental setting, water and related land resource problems, environmental impacts, project alternatives, and the irreversible and irretrievable commitment of resources.

INSTALLATION COSTS-MONETARY

Public Law 46 funds, in the amount of about $8,350 for technical assistance during the five-year installation period, will be provided to continue the planning and application of land treatment under the going program. Local interests will apply the planned land treatment at an estimated cost of $48,650, which includes expected partial reimbursements from the Agricultural Conservation Program (ACP) of the Agricultural Stabilization and Conservation Service (ASCS). The costs of application of the various measures are based on current average prices being paid by landowners and operators in the area. The estimated cost of land treatment includes cost for reapplication of recurring management practices that would be applied annually during the installation period (Table 1).

Total installation cost of the structural measures is estimated to be $5,911,860, of which $4,447,270 will be borne by Public Law 566 funds and $1,464,590 will be borne by other funds (Table 1).

Total cost for installing the five floodwater retarding structures is estimated to be $5,704,380, of which $4,346,520 will be borne from Public Law 566 funds, $1,334,590 by the Reclamation and Flood Control District, and $23,270 from other Federal funds (Table 2). Public Law 566 costs include $3,558,430 for construction, $264,950 for engineering services, and $523,140 for project administration. Costs for studies or mitigation as appropriate to minimize impacts on archeological resources are estimated to be $23,270.

Local costs for project installation of the floodwater retarding structures (less the costs for archeological mitigation) total $1,334,590 (Table 2), which include $1,011,500 for the value of the land; $302,590 for fences, water well, pipeline, private roads, power lines, corrals, water troughs, and storage facilities; $10,500 for legal fees; and $10,000 for project administration ($5,000 for construction inspection and $5,000 for other). Other costs for project administration include

the Sponsors' costs related to contract administration overhead and organizational administrative costs, and construction inspection they may desire to make at their own expense.

Total cost for installing the water resource improvement is estimated to be $18,440, of which $11,130 will be borne from Public Law 566 funds and $7,310 by the City. Public Law 566 cost includes $6,230 for construction, $1,740 for engineering services, and $3,160 for project administration (Table 2). The SCS will design the water resource improvement and provide this design to an architectural and engineering (A&E) consultant. This design will be incorporated into the final design and siting of the recreational facilities. Local cost for installing the water resource improvement totals $7,310 (Table 2), which includes $6,230 for construction, $380 for land rights, $500 for legal fees, and $200 for project administration ($100 construction inspection and $100 for other).

The total cost for installation of the recreational facilities is estimated to be $189,040, of which $89,620 will be borne by Public Law 566 funds and $99,420 by the City. Public Law 566 costs are estimated to be $72,380 for construction, $7,240 for engineering, and $10,000 for project administration. Local cost for installing the recreational facilities totals $99,420 (Table 2), which includes $72,380 for construction, $10,680 for land rights, $7,240 for engineering (City's 50-50 cost share of A&E consultant), $500 legal fees, and $8,620 for project administration ($7,620 for construction inspection and $1,000 for other). Regardless of the method used to install planned work, the SCS and the City will each bear 50 percent of the actual eligible construction costs of basic recreational facilities. Any cost incurred for obtaining loans, land and water rights, legal fees, flowage easements, and surveys associated therewith will be borne 100 percent by the City.

The costs of the A&E contract for the basic facilities will be shared 50-50 by the SCS and the City. The SCS and the City will provide technical assistance to review and concur in all construction plans and specifications. The SCS will supervise construction of basic facilities and the City will make whatever inspections they desire at their own expense.

The costs shown in this plan represent preliminary estimates. In finally determining the costs to be borne by each party, the actual costs incurred in the installation of the measure will be used. The distribution of estimated installation costs by source of funds is presented on Table 2. Items, numbers, estimated unit costs, and total costs for basic recreation facilities are presented on Table 2A.

The construction cost estimate was based on the unit cost of structural measures in similar areas modified by special conditions inherent to the site locations. Ten percent of the estimate was added as a contingency to provide funds for unpredictable construction costs.

Engineering services cost consist of, but are not limited to, detailed surveys, geologic investigations, laboratory analysis, reports, designs, and cartographic services. Public Law 566 project administration costs consist of construction inspection, contract administration, and maintenance of the SCS State Office records and accounts.

The value of land rights was determined by representatives of the Sponsors.

ECONOMIC BENEFITS

The average annual benefits from flood damage reduction are $851,720. Average annual benefits from recreational facilities are $56,300 (Tables 5 and 6).

The total average annual primary benefits accruing from structural measures are expected to be $908,020. The total average annual cost of the structural measures (amortized total installation and project administration costs, plus operation and maintenance and replacement) is $410,820 (Table 4). This results in a benefit cost ratio of 2.2 to 1.0 (Table 6).

It is estimated that the project will generate regional external economies averaging $6,540 annually. External economies from a national viewpoint were not considered pertinent to the economic evaluation.

INSTALLATION AND FINANCING

The following is the estimated schedule of obligations for a five-year installation period.

Schedule of Obligations

Fiscal Year	Measures	Public Law 566 Funds (dollars)	Other Funds (dollars)	Total (dollars)
First	Water Resource Improvement	11,130	7,310	18,440
	Recreational Facilities	89,620	99,420	189,040
	Floodwater Retarding Structures		1,054,590	1,054,590
Second	Structure No. 4	636,060	2,000	638,060
	Cultural Resources Protection		23,270 1/	23,270
	Floodwater Retarding Structures		270,000	270,000
Third	Structure No. 5	1,042,130	2,000	1,044,130
Fourth	Structure No. 1	1,419,080	2,000	1,421,080
Fifth	Structures Nos. 2 & 3	1,249,250	4,000	1,253,250
Total		4,447,270	1,464,590	5,911,860

1/ Responsibility of National Park Service with funds allocated under Public Law 93-291.

This schedule may be changed from year to year to conform with appropriations, accomplishments, and any mutually desirable changes.

The five floodwater retarding structures will be constructed during the second through the fifth year of the project installation period. The water resource improvement and recreational facilities will be installed during the first year of the project installation period.

Technical assistance will be provided by the SCS in preparation of plans and specifications, construction inspection, preparation of contract payment estimates, final inspection, execution of certificate of completion, and related tasks necessary to install the structural measures. The SCS and the City will enter into an agreement for the negotiation of an A&E contract with a private engineering firm to prepare construction plans and specifications for the recreational facilities.

The Reclamation and Flood Control District will represent the Sponsors in coordination with the SCS on matters concerning construction of the floodwater retarding structures. Similarly, the City will represent the Sponsors on all matters concerning the installation of the water resource improvement and construction of the recreational facilities.

The Reclamation and Flood Control District will have the following responsibilities pertaining to the floodwater retarding structures:

1. Obtain the necessary land rights.

2. Provide for any needed changes in location or modification of private road, power lines, pipeline, fences, corral, water well, and water storage facility and trough.

3. Determine and certify legal adequacy of easements and permits for construction of the floodwater retarding structures.

The County will have the following responsibility pertaining to the floodwater retarding structures:

Provide for the necessary improvements to crossings on county roads which would be adversely affected.

The City will have the following responsibilities pertaining to the water resource improvement and recreational facilities:

1. Obtain necessary land rights.

2. Determine and certify legal adequacy of easements and permits for construction and/or installation of the water resource improvement and recreational facilities.

In the event that any low water crossing will be adversely affected or made impassable by prolonged release flow from the floodwater retarding structures, action may be necessary by the Sponsors.

Land rights for all structural measures are to be secured before any construction begins. The minimum land rights required will be those necessary to construct, operate, maintain, and inspect the structural measures. The schedule of obligations will begin when the Plan is approved for operations.

The Sponsors have requested the SCS to administer contracts.

Under present conditions there will be no apparent displacements or relocations of persons, businesses, or farm operations as a result of installation of the structural measures. If relocations or displacements become necessary, they will be carried out under the provisions of Public Law 91-646, Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

The proposed project will provide flood-free protection from a 100-year frequency event to all existing urban properties except a tourist-recreation development and an apartment complex. The 100-year frequency flood with project conditions is a maximum of 4.3 feet deep in one section of the apartment complex and 0.8 foot deep in the tourist-recreation complex. These depths are measured above floor elevations. At the present time relocation or floodproofing these properties is not feasible. Realizing the flood hazard, the City and the County agree to:

> Publicize annually the nature and extent of the remaining flood hazards to life and property in those areas subject to flooding from the 100-year event.

The City agrees to:

> Notify annually the owners and occupants of the apartment complex and the tourist-recreation development of the flood hazard at their properties.

The Reclamation and Flood Control District, the County, and the City have rights of eminent domain under applicable state law and have the financial resources to fulfill their responsibilities.

The five floodwater retarding structures will be constructed pursuant to the following conditions:

1. Certification that land treatment requirements in drainage areas of the floodwater retarding structures have been satisfied.

2. All needed land rights and permits have been obtained for all floodwater retarding structures.

3. Project agreements have been executed.

4. Operation and maintenance agreements have been executed.

5. All required flood plain regulations have been enacted and are in effect.

The water resource improvement and basic recreation facilities will be constructed and/or installed pursuant to the following conditions:

1. All needed land rights or permits have been obtained.

2. Obtain any permit needed by Section 404 of Public Law 92-500.

3. Operation and maintenance agreement has been executed.

4. Construction plans and specifications have been agreed to by the parties hereto.

5. Project agreement and A&E services agreement have been executed.

The structural measures will affect a total of 17 archeological sites, three of which are considered eligible for nomination to the National Register of Historic Places. These three archeological sites will be mitigated or preserved with the concurrence of the State Historic Preservation Officer.

If any previously unidentified evidence of cultural values are discovered prior to or during construction, the procedures in Public Law 93-291 will be followed. There will be no change in the existing responsibilities of the SCS under Executive Order 11593. Mitigation will be accomplished as set forth in Title 7, Code of Federal Regulations, Part 656, "Procedures for the Protection of Archeological and Historical Properties Encountered in SCS-assisted Programs."

Federal assistance for carrying out works of improvement described in this Plan will be provided under authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, 68 Stat. 666), as amended. Funds allocated under Public Law 566 for financial and technical assistance are contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

Funds for the local share of the construction of the five floodwater retarding structures will be provided by the Reclamation and Flood Control District through tax revenue and the sales of bonds. Operation and maintenance funds for the five floodwater retarding structures will be provided from the general fund of the County. Funds used to pay for the local cost-share of the water resource improvement and recreational facilities will be provided by the City from Community Development Funds administered by Department of Housing and Urban Development (HUD). In addition, the City will be responsible for the operation, maintenance, and replacement of the water resource improvement and recreational facilities which will be financed by funds from existing tax revenue.

Each Sponsor has the financial ability to make adequate arrangements to carry out their responsibilities in all phases of project installation and in operation, maintenance, and replacement. A preliminary application for a watershed loan was made by the Reclamation and Flood Control District and has been approved by the State Director of the Farmers Home Administration (FmHA) subject to the availability of funds and a mutually agreed to plan. Other assistance for land rights, project administration, etc. may be available through the use of Community Development Funds.

Financial assistance is available from several sources to assist land users in the application of conservation measures on farms and ranches. Loans to land users for conservation measures are available through the Soil and Water Conservation Program administered by the FmHA and through local commercial lending institutions.

Cost-share assistance is available through the Agricultural Conservation Program administered by the Agricultural Stabilization and Conservation Service. Technical assistance to be furnished by the SCS is contingent upon the appropriation of funds for this purpose.

It is anticipated that the cost for archeological mitigation will be borne by the National Park Service with funds appropriated under Public Law 93-291.

OPERATION, MAINTENANCE, AND REPLACEMENT

Land Treatment

The operation and maintenance of applied conservation land treatment under the going program will be essentially the responsibility of land users. District Cooperators agree to maintain all applied conservation practices which are installed with technical assistance from the SWCD. Technical assistance will be provided to land users to maintain applied conservation practices. The SWCD will make periodical field inspections of the watershed and maintain personal communications with land users to determine the status of applied land treatment.

Structural Measures

The County will be responsible for operation and maintenance of the floodwater retarding structures. Cost of operation and maintenance for the five floodwater retarding structures is estimated to be $980 annually. Monies for operation and maintenance will be supplied from the general fund of the County. This fund is supported by tax revenue. Each year the County will budget sufficient funds for the operation and maintenance responsibilities.

For a period of three years, the floodwater retarding structures will be inspected at least annually and after each heavy rain by representatives of the County, the SWCD, and the designated SCS representative.

Upon completion of each floodwater retarding structure, the County will assume responsibility for operation and maintenance of the structure. The County or their representative will perform promptly all maintenance of the structures as determined to be needed by either the Sponsors or the SCS, including that required to prevent soil erosion and water pollution. Trash racks on each principal spillway will require occasional maintenance to keep them in proper working condition. Bent and damaged grill work will be straightened or replaced.

The City will be responsible for operation and maintenance of the water resource improvement at an estimated annual cost of $250. In addition, the City will be responsible for operation, maintenance, and replacement of the recreational facilities at an annual cost of $17,280. These costs include custodial, policing, sanitation, safety, and an allowance for replacement. Annual replacement costs are estimated to be $2,500.

The City will be responsible for replacement or major renovation of each item to insure the continued integrity of the recreational facilities for the planned life of the project (100 years). Existing vegetation along the San Marcos River will be maintained and not disturbed except for occasional replacement with better adapted species. Newly planted landscape material (screening, wildlife cover, and habitat protection) will be watered and fertilized as necessary to assure establishment and maintenance. As a safety precaution, the City will close the park area to the public during flood stage.

For a period of three years, inspection of the water resource improvement and recreational facilities will be made annually by the City and the SCS. Annual inspections after the third year will be made by the City and a report furnished to the SCS. After the third year, the SCS will make additional inspections periodically as deemed necessary.

A specific operation and maintenance agreement will be prepared for each structural measure and will be executed prior to signing a project agreement. The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with Public Law 566 financial assistance. The agreement will set forth specific details on procedures in line with recognized assignments of responsibility and will be in accordance with the Texas Watersheds Operation and Maintenance Handbook.

Sponsors will also control the handling, use, and application of any herbicides and pesticides that may be needed for operation and maintenance of structural measures. If the use of chemicals should be required, only approved and authorized reagents and compounds will be used. Their application will be compatible with current laws regulating their use. In addition to prudent judgment, ordinances and standards concerned with the disposal of storage of unused chemicals, empty containers, contaminated equipment, etc. will be observed and applied.

The SCS will participate in operation and maintenance only to the extent of furnishing technical assistance necessary for the operation and maintenance program.

Provisions will be made for unrestricted access by representatives of the Sponsors and SCS to inspect all structural measures and their appurtenances at any time and for the Sponsors to perform operation and maintenance. Easements insuring this unrestricted ingress and egress will be furnished by the Sponsors.

The County and the City will maintain a record of all maintenance inspections performed, maintenance applied, and cost of such maintenance and have it available for inspection by SCS personnel.

The necessary maintenance work will be accomplished by contracts, force accounts, or equipment owned by the Sponsors.

AGREEMENT

between the following local organizations:

Upper San Marcos Watershed Reclamation and Flood Control District
Hays County Commissioners Court
City of San Marcos
Comal-Hays-Guadalupe Soil and Water Conservation District
(Referred to herein as Sponsors)
State of Texas

and the

Soil Conservation Service
United States Department of Agriculture
(Referred to herein as SCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by local organization(s) for assistance in preparing a plan for works of improvement for the Upper San Marcos River Watershed, State of Texas, under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); and whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Soil Conservation Service (SCS); and

Whereas, there has been developed through the cooperative efforts of local organizations and SCS this plan for works of improvement for the Upper San Marcos River Watershed, State of Texas:

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through the Soil Conservation Service, and the Sponsors hereby agree on this plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this watershed plan and including the following:

1. The Sponsors will acquire, with other than PL 566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated Cost $1,336,650)

2. The Sponsors assure that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsors and SCS as follows:

	Sponsors (percent)	SCS (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	24.8	75.2	0 1/

3. The Sponsors will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs to be paid by the Sponsors and by SCS are as follows:

Works of Improvement	Sponsors (percent)	SCS (percent)	Estimated Construction Costs (dollars)
Five (5) Floodwater Retarding Structures	0	100	3,558,430
One (1) Water Resource Improvement	50	50	12,460
One (1) Recreational Facility	50	50	144,760

5. The percentages of the engineering costs to be borne by the Sponsors and SCS are as follows:

Works of Improvement	Sponsors (percent)	SCS (percent)	Estimated Engineering Costs (dollars)
Five (5) Floodwater Retarding Structures	0	100	264,950
One (1) Water Resource Improvement	0	100	1,740
One (1) Recreational Facility to be performed by A&E Contract	50	50	14,480

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

6. The Sponsors and SCS will each bear the costs of Project Administration which it incurs, estimated to be $18,820 and $536,300, respectively.

7. The Sponsors will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

8. The Sponsors will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsors will be responsible for the operation, maintenance, and replacement of the works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

10. The costs shown in this Plan represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

11. This Agreement is not a fund obligating document. Financial and other assistance to be furnished by SCS in carrying out the Plan are contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

12. A separate agreement will be entered into between SCS and Sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. This Plan may be amended, revised, or terminated only by mutual agreement of the parties hereto, except that SCS may terminate financial and other assistance in whole, or in part, at any time it determines that the Sponsors have failed to comply with the conditions of this Agreement. In this case, SCS shall promptly notify the Sponsors in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsors or recoveries by SCS under projects terminated shall be in accord with the legal rights and liabilities of the parties. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between SCS and the Sponsors having specific responsibilities for the measure involved.

14. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this Agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 CFR 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.

Upper San Marcos Watershed Reclamation and Flood Control District
Local Organization

By Shirley L. Tuttle
SHIRLEY L. TUTTLE
Title CHAIRMAN

P. O. Box 1334
San Marcos, Texas 78666
Address Zip Code

Date 10-12-78

The signing of this agreement was authorized by a resolution of the governing body of the Upper San Marcos Watershed Reclamation and Flood Control District
Local Organization
adopted at a meeting held on 10-12-78

Bruce F. Harper
Secretary, Local Organization
Bruce F. Harper
Date 10-12-78

P.O. Box 887; San Marcos, Texas 78666
Address Zip Code

Hays County Commissioners Court
Local Organization

By Walter Burnett
Walter Burnett
Title County Judge

San Marcos, Texas 78666
Address Zip Code

Date 10-23-78

The signing of this agreement was authorized by a resolution of the governing body of the Hays County Commissioners Court
Local Organization
adopted at a meeting held on 10-23-78

Secretary, Local Organization
Linda C. Fritsche
Date 10-23-78

Hays County Courthouse; San Marcos 78666
Address Zip Code

City of San Marcos
Local Organization

By Robert L. Cavazos
Robert L. Cavazos
Title Mayor

San Marcos, Texas 78666
Address Zip Code

Date 10-17-1978

The signing of this agreement was authorized by a resolution of the governing body of the City of San Marcos
Local Organization
adopted at a meeting held on October 16, 1978

Secretary, Local Organization
Doriss Hambrick
Date 10-17-1978

630 E. Hopkins, San Marcos, Tx. 78666
Address Zip Code

Comal-Hays-Guadalupe Soil and Water Conservation District
Local Organization

By Herman Blank
Herman Blank
Title Chairman

P. O. Box 956
New Braunfels, Texas 78130
Address Zip Code

Date 10-3-78

The signing of this agreement was authorized by a resolution of the governing body of the Comal-Hays-Guadalupe Soil and Water Conservation District
Local Organization
adopted at a meeting held on 10-3-78

Secretary, Local Organization
Milton Dietert
Date 10-3-78

Rt.1, Box 113 Seguin, Texas 78155
Address Zip Code

Appropriate and careful consideration has been given to the Environmental Impact Statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

George C. Marks
State Conservationist

OC 1978
Date

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Upper San Marcos River Watershed

Installation Cost Item	Unit	Number Non-Federal Land	Estimated Cost (Dollars) 1/ Public Law 566 Funds Non-Federal Land	Other 2/ Non-Federal Land	Total
STRUCTURAL MEASURES					
Floodwater Retarding Structures	No.	5	3,823,380	1,347,860	5,171,240
Water Resource Improvement	No.	1	7,970	7,110	15,080
Recreational Facilities	No.	1	79,620	90,800	170,420
Subtotal - Structural Costs			3,910,970	1,445,770	5,356,740
Project Administration					
Construction Inspection			219,490	12,720	232,210
Other			316,810	6,100	322,910
Subtotal - Administration for Structural Measures			536,300	18,820	555,120
TOTAL PROJECT COSTS			4,447,270	1,464,590	5,911,860

1/ Price Base: 1976
2/ Does not include $48,650 and $8,350 to be provided by local interests and SCS, respectively, for the application of going program land treatment on about 9,300 acres of agricultural land.

July 1978

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
Upper San Marcos River Watershed
(Dollars) 1/

Item	Installation Costs P. L. 566 Funds: Construction	Engineering	Total P.L. 566	Installation Costs Other Funds: Construction	Engineering	Land Rights 2/	Cultural Resources Protection 3/	Total Other	Total Installation Costs
STRUCTURAL MEASURES									
Floodwater Retarding Structures									
1	1,166,360	81,650	1,248,010	-	-	670,600	8,270	678,870	1,926,880
2	327,030	29,430	356,460	-	-	113,320	-	113,320	469,780
3	690,900	51,820	742,720	-	-	154,470	15,000	169,470	912,190
4	519,110	40,490	559,600	-	-	175,000	-	175,000	734,600
5	855,030	61,560	916,590	-	-	211,200	-	211,200	1,127,790
SUBTOTAL	3,558,430	264,950	3,823,380	-	-	1,324,590	23,270	1,347,860	5,171,240
Water Resource Improvement	6,230	1,740	7,970	6,230	-	880	-	7,110	15,080
Recreation Facilities	72,380	7,240	79,620	72,380	7,240	11,180	-	90,800	170,420
SUBTOTAL-Structural	3,637,040	273,930	3,910,970	78,610	7,240	1,336,650	23,270	1,445,770	5,356,740
PROJECT ADMINISTRATION			536,300					18,820	555,120
GRAND TOTAL	3,637,040	273,930	4,447,270	78,610	7,240	1,336,650	23,270	1,464,590	5,911,860

1/ Price Base: 1976

2/ Includes $1,022,560 for land values, $20,090 for powerlines, $7,500 for fence modification or relocation, $2,000 for corrals, $500 for water wells, $2,500 for water troughs and storage facilities, $270,000 for pipeline modification and $11,500 for legal fees.

3/ Responsibility of National Park Service with funds allocated under Public Law 93-291. On a site by site basis, Soil Conservation Service may transfer up to one percent of the estimated construction cost to National Park Service for this purpose.

July 1978

TABLE 2A - RECREATIONAL FACILITIES

ESTIMATED CONSTRUCTION COSTS

Upper San Marcos River Watershed, Texas

(Dollars) 1/

Item	Number 2/	Estimated Unit Cost	Total Construction Cost
Picnic Tables (6' Alum)	16	200	3,200
Grills (waist high)	12	100	1,200
Garbage Cont. (55 gal. drums)	12	80	960
Trail (surfacing-gravel)	2,400 feet	3	7,200
Trail (grading & shaping)	250 feet	4	1,000
Fishing Pier (10x30 wood)	3	2,300	6,900
Water Fountain	2	200	400
Water Faucet	2	100	200
Water Line	200 feet	2	400
Sewage Line	200 feet	5	1,000
Rest Rooms (20x24 feet)	2	20,000	40,000
Parking (24 cars-asphalt)	24	100	2,400
Access Road (20' asphalt)	1,600	15	24,000
Traffic Barriers (post & cable)	1,000 feet	2.50	2,500
Entrance Signs	2	250	500
Group Shelter (octagonal wood-40' diameter)	1	8,300	8,300
Picnic Tables (15' Alum)	4	500	2,000
Benches (6' Alum)	4	150	600
Landscaping (screening and wildlife)	Lump Sum	4,000	4,000
Lighting	Lump Sum	18,000	18,000
Bridges	2	10,000	20,000
GRAND TOTAL			144,760

1/ Price base: 1976

2/ Estimated quantity subject to minor variation at time of detailed planning, except rest rooms, group shelter, and bridges.

July 1978

TABLE 3 - STRUCTURAL DATA -
STRUCTURES WITH PLANNED STORAGE CAPACITY

Upper San Marcos River Watershed, Texas

Item	Unit	Structure Number 1	2	3
Class of Structure		C	C	C
Drainage Area				
Uncontrolled	Sq.Mi.	33.57	4.35	5.67
Controlled	Sq.Mi.	-	-	37.92
Curve No. (1-day)(AMC II)		70	69	70
Tc	Hr.	3.89	1.28	1.53
Elevation Top of Dam	Ft.	762.1	726.7	647.4
Elevation Crest Emergency Spillway	Ft.	742.3	715.0	628.0
Elevation Crest Principal Spillway	Ft.	698.6	691.5	611.0
Elevation Crest Lowest Ungated Outlet	Ft.	693.0	691.5	611.0
Maximum Height of Dam	Ft.	80	50	60
Volume of Fill	Cu.Yds.	657,260	142,400	143,230
Total Capacity	Ac.Ft.	8,683	1,275	1,011
Sediment Pool (Lowest Ungated Outlet)1/2/	Ac.Ft.	107	93	127
Sediment Pool-Principal Spillway Crest	Ac.Ft.	304	93	127
Sediment in Detention Pool - Aerated	Ac.Ft.	18	5	6
Retarding Pool	Ac.Ft.	8,361	1,177	878
Surface Area				
Sediment Pool (Lowest Ungated Outlet)	Acres	25	17	20
Sediment Pool-Principal Spillway Crest	Acres	51	17	20
Retarding Pool	Acres	395	102	85
Principal Spillway				
Rainfall Volume (areal)(1-day)	In.	9.68	10.10	9.61
Rainfall Volume (areal)(10-day)	In.	16.07	16.40	16.01
Runoff Volume (10-day)	In.	6.66	7.92	6.48
Capacity (Maximum)	Cfs.	342	114	936
Size of Conduit	In.	48	30	72x72
Emergency Spillway				
Frequency Operation-Emergency Spillway	% chance	1.0	1.0	1.0
Rainfall Volume (ESH)(areal)	In.	12.25	13.55	12.10
Runoff Volume (ESH)	In.	8.28	9.34	8.14
Type		Rock	Rock	Rock
Bottom Width	Ft.	300	150	300
Velocity of Flow (Ve)	Ft./Sec.	20.0	13.5	17.3
Slope of Exit Channel	Ft./Ft.	0.019	0.025	0.014
Maximum Water Surface Elevation	Ft.	751.0	719.4	636.1
Freeboard				
Rainfall Volume (FH)(areal)	In.	28.20	31.25	27.75
Runoff Volume (FH)	In.	23.64	26.44	23.20
Maximum Water Surface Elevation	Ft.	762.1	726.7	647.4
Capacity Equivalents				
Sediment Volume	In.	0.18	0.42	0.44
Retarding Volume	In.	4.67	5.07	2.90

1/ Volume included in sediment pool (Principal Spillway Crest)
2/ Additional volume may be created by excavation of earth materials for dam; total volume at lowest ungated outlet will not exceed 200 acre-feet in each structure.

TABLE 3 - STRUCTURAL DATA -
STRUCTURES WITH PLANNED STORAGE CAPACITY (continued)

Upper San Marcos River Watershed, Texas

Item	Unit	Structure Number 4	5	Total
Class of Structure		C	C	
Drainage Area				
Uncontrolled	Sq.Mi.	20.17	14.41	78.17
Controlled	Sq.Mi.	-	20.17	xxx
Curve No. (1-day)(AMC II)		70	70	xxx
Tc	Hr.	4.44	2.08	xxx
Elevation Top of Dam	Ft.	892.4	667.2	xxx
Elevation Crest Emergency Spillway	Ft.	874.4	650.8	xxx
Elevation Crest Principal Spillway	Ft.	815.0	618.1	xxx
Elevation Crest Lowest Ungated Outlet	Ft.	813.6	616.2	xxx
Maximum Height of Dam	Ft.	100	72	xxx
Volume of Fill	Cu.Yds.	253,940	377,450	1,574,280
Total Capacity	Ac.Ft.	4,788	3,167	18,924
Sediment Pool (Lowest Ungated Outlet)1/2/	Ac.Ft.	194	161	682
Sediment Pool-Principal Spillway Crest	Ac.Ft.	215	215	954
Sediment in Detention Pool - Aerated	Ac.Ft.	11	8	48
Retarding Pool	Ac.Ft.	4,562	2,944	17,922
Surface Area				
Sediment Pool (Lowest Ungated Outlet)	Acres	19	23	104
Sediment Pool-Principal Spillway Crest	Acres	21	30	139
Retarding Pool	Acres	180	172	934
Principal Spillway				
Rainfall Volume (areal)(1-day)	In.	9.79	9.67	xxx
Rainfall Volume (areal)(10-day)	In.	16.17	16.06	xxx
Runoff Volume (10-day)	In.	6.97	6.64	xxx
Capacity (Maximum)	Cfs.	490	797	xxx
Size of Conduit	In.	48	60x60	xxx
Emergency Spillway				
Frequency Operation-Emergency Spillway	% chance	1.0	1.0	xxx
Rainfall Volume (ESH)(areal)	In.	12.87	13.27	xxx
Runoff Volume (ESH)	In.	8.85	9.23	xxx
Type		Rock	Rock	xxx
Bottom Width	Ft.	250	300	xxx
Velocity of Flow (Ve)	Ft./Sec.	19.0	18.0	xxx
Slope of Exit Channel	Ft./Ft.	0.020	0.021	xxx
Maximum Water Surface Elevation	Ft.	881.8	657.8	xxx
Freeboard				
Rainfall Volume (FH)(areal)	In.	29.69	30.55	xxx
Runoff Volume (FH)	In.	25.10	25.95	xxx
Maximum Water Surface Elevation	Ft.	892.4	667.2	xxx
Capacity Equivalents				
Sediment Volume	In.	0.21	0.29	xxx
Retarding Volume	In.	4.24	3.83	xxx

1/ Volume included in sediment pool (Principal Spillway Crest)
2/ Additional volume may be created by excavation of earth materials for dam; total volume at lowest ungated outlet will not exceed 200 acre-feet in each structure.

TABLE 4 - ANNUAL COST

Upper San Marcos River Watershed, Texas

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost 2/	Operation and Maintenance Cost 3/	Total
Floodwater Retarding Structures Numbers 1 through 5, Water Resource Improvement and Recreational Facilities	355,470	18,510	373,980
Project Administration	36,840	0	36,840
GRAND TOTAL	392,310	18,510	410,820

1/ Price Base: 1976

2/ 100-years at 6.625 percent interest

3/ Includes $17,280 for operation, maintenance, and replacement for the recreational facilities and $250 for operation and maintenance of the water resource improvement.

July 1978

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Upper San Marcos River Watershed, Texas

(Dollars) 1/

Item	Estimated Average Annual Damage: Without Project	Estimated Average Annual Damage: With Project	Damage Reduction Benefits
Floodwater			
Crop and Pasture	13,560	1,930	11,630
Other Agricultural	6,860	860	6,000
Nonagricultural			
Automobiles	29,920	0	29,920
Railroads	1,320	0	1,320
Urban 2/			
Residential Property	611,360	20,400	590,620
Commercial Property	46,780	420	46,360
Public Property	28,050	0	28,050
Streets and Utilities	27,960	810	27,150
Subtotal	765.810	24,420	741,390
Indirect	113.850	3,520	110,330
TOTAL	879,660	27,940	851,720

1/ Price Base: Crop and pasture damages current normalized prices, all other 1976.

2/ Evaluation of damages resulting from floods up to and including a 100-year frequency event for agricultural and 500-year frequency event on urban areas.

July 1978

TABLE 6 - COMPARISON OF BENEFITS AND COSTS

Upper San Marcos River Watershed, Texas

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/ Damage Reduction 2/	Recreation	Total	Average Annual Cost 3/	Benefit Cost Ratio
Floodwater Retarding Structures Numbers 1 through 5, Water Resource Improvement, and Recreational Facilities	851,720	56,300	908,020	373,980	2.4:1.0
Project Administration				36,840	
GRAND TOTAL	851,720	56,300	908,020	410,820	2.2:1.0

1/ Price Base: Crop and pasture current normalized prices, all other 1976.

2/ From Table 5

3/ From Table 4

July 1978

ENVIRONMENTAL IMPACT STATEMENT

UPPER SAN MARCOS RIVER WATERSHED

Comal and Hays Counties, Texas

July 1978

USDA-SCS-EIS-WS-(ADM)-78-2-(F)-(TX)

UPPER SAN MARCOS RIVER WATERSHED
Comal and Hays Counties, Texas

FINAL ENVIRONMENTAL IMPACT STATEMENT

George C. Marks
State Conservationist
Soil Conservation Service

Sponsoring Local Organizations

Upper San Marcos Watershed Reclamation and Flood Control District
P. O. Box 1334
San Marcos, Texas 78666

Hays County Commissioners Court
San Marcos, Texas 78666

City of San Marcos
San Marcos, Texas 78666

Comal-Hays-Guadalupe Soil and Water Conservation District
P. O. Box 956
New Braunfels, Texas 78130

July 1978

PREPARED BY

UNITED STATES DEPARTMENT OF AGRICULTURE

Soil Conservation Service

P. O. Box 648
Temple, Texas 76501

USDA ENVIRONMENTAL IMPACT STATEMENT

The Upper San Marcos River Watershed Project
Comal and Hays Counties
Texas

Prepared in Accordance with Sec. 102 (2)(C) of P. L. 91-190

SUMMARY

I. Final

II. Soil Conservation Service

III. Administrative

IV. Description of Action:
A plan for watershed protection and flood prevention for the 95 square miles (60,780 acres) drainage area of the Upper San Marcos River Watershed in Comal and Hays Counties, Texas, will be carried out by the Sponsoring Local Organizations with assistance from the Soil Conservation Service, USDA, under the authority of Public Law 566, 83d Congress, 68 Stat. 666, as amended. During a five-year installation period, the Plan proposes accomplishment of land treatment under the going program; continued enforcement of flood plain zoning; and construction of five single-purpose floodwater retarding structures, water resource improvement, and water-based recreational facilities.

V. Summary of Environmental Impacts:
1. Owners and operators of 17 farms and ranches will benefit from an 87 percent reduction in average annual flooding, from 1,270 acres to 169 acres.
2. Expenses and inconveniences associated with interruption or delay of travel will be reduced.
3. Flood reduction will be provided to 908 residential properties, 92 business establishments, and 23 public buildings.
4. Recreation days will increase by 22,430 annually.
5. Suspended sediment at the mouth of the watershed will be reduced 73 percent, from 110 milligrams per liter to 30 milligrams per liter.
6. The Edwards Underground Reservoir will be recharged by an additional 4,680 acre-feet annually.
7. Wildlife in the watershed will be affected as follows:
   a. Unique aquatic habitats along the San Marcos River will be protected from human encroachment.
   b. Fauna living in the subterranean ecosystem of the Edwards Aquifer will be benefited.

8. Endangered species in the watershed will be affected as follows:
   a. Aquatic habitat of the endangered fountain darter, Texas wildrice, and other unique species will be afforded protection.
   b. The habitat of the endangered Texas blind salamander will be benefited.
   c. Unique habitat of the San Marcos salamander will not be affected.
9. Increased economic activity will create the equivalent of two permanent jobs for local residents. Construction of the structural measures will create approximately 266 man-years of employment.
10. Public and private funds presently used to repair flood damages can be shifted to more permanent investments that improve the quality of living.
11. Injury, loss of life, and health hazards associated with floods will be reduced.
12. Provide flood damage reduction benefits to the Cock House, a National Historic Landmark.
13. Dust, sediment, and noise pollution will increase during the construction.
14. Seventeen archeological sites, three of which are considered eligible for nomination to the National Register of Historic Places, will be affected by construction or inundation.
15. Wildlife habitat in the watershed will be adversely affected as follows:
   a. Installation of the five floodwater retarding structures will destroy, alter, or inundate approximately 2.9 miles of natural stream channel, all of which have ephemeral flow.
   b. Wildlife upland habitat on 346 acres will be destroyed for construction and proper functioning of the five floodwater retarding structures.
   c. Habitat value will be reduced on the remaining 60 acres that will be left uncleared in the sediment pools.
   d. Inundate a maximum of 795 acres of upland habitat in the detention pools.
   e. Destroy one turkey roost located in the sediment pool of Structure No. 2.

VI. List of Alternatives Considered (all include flood plain regulation):
1. NED Plan - Five floodwater retarding structures, water resource improvement, and recreational facilities.
2. Levee system (68,000 feet), water resource improvement, and recreational facilities.
3. Channel work (7.6 miles) on selected stream courses, water resource improvement, and recreational facilities.

4. Relocation of flood plain residential units, business establishments, and public buildings.
5. Foregoing the implementation of a project.

VII. Agencies from Which Comments were Received:
U.S. Department of Health, Education, and Welfare; U.S. Department of the Interior; U.S. Environmental Protection Agency; Advisory Council on Historic Preservation; Office of Equal Opportunity, USDA; Budget and Planning Office (State agency designated by Governor and State Clearinghouse); and Capitol Area Planning Council and Alamo Area Council of Governments (Regional Clearinghouses).

USDA SOIL CONSERVATION SERVICE

FINAL ENVIRONMENTAL IMPACT STATEMENT

for

UPPER SAN MARCOS RIVER WATERSHED

Comal and Hays Counties, Texas

AUTHORITY

Installation of this project constitutes an administrative action. Federal assistance will be provided under authority of Public Law 83-566, 83d Congress, 68 Stat. 666, as amended.

SPONSORING LOCAL ORGANIZATIONS

Upper San Marcos Watershed Reclamation and Flood Control District
Hays County Commissioners Court
City of San Marcos
Comal-Hays-Guadalupe Soil and Water Conservation District

PROJECT PURPOSES AND GOALS

The overall objective of the project is the conservation, development, and productive use of the watershed's soil, water, and related resources so that residents can enjoy:

QUALITY IN THE NATURAL RESOURCE BASE FOR SUSTAINED USE

QUALITY IN THE ENVIRONMENT TO PROVIDE ATTRACTIVE, CONVENIENT, AND SATISFYING PLACES TO LIVE, WORK, AND PLAY

QUALITY IN THE STANDARD OF LIVING BASED ON COMMUNITY IMPROVEMENT AND ADEQUATE INCOME

Specific project goals were identified in terms of two co-equal planning objectives: National Economic Development (NED) - increased production of goods and services; and Environmental Quality (EQ) - enhancement of physical, ecological, and aesthetic characteristics.

An initial study was made by representatives of the SCS and the Sponsors to determine watershed resource problems and potentials, examine possible solutions, and identify project goals. Preliminary goals were established through public involvement with technical input from state and other Federal agencies, and resource inventories and evaluation. The following is a listing of the goals:

OBJECTIVE	GOAL
NED	1. Obtain a reduction of 90-95 percent in average annual flood damages to urban property in the flood plain.
	2. Obtain a reduction of 60 to 75 percent in average annual flood damages to agricultural flood plain lands.
	3. Provide opportunities for water-based recreational facilities and a water resource improvement along the San Marcos River.
EQ	1. Create an area of scenic beauty for man's enjoyment.
	2. Improve water quality by reducing sediment and related pollutants.
	3. Avoid damage or destruction of cultural resources of national significance.
	4. Maintain subterranean ecosystems.
	5. Avoid disturbance of endangered or threatened species and their critical habitats.
	6. Minimize irreversible or irretrievable commitment of non-renewable resources.

As planning progressed, it became apparent that most of the project goals could be satisfied. Watershed protection and flood prevention continued to be the primary goal expressed by the Sponsors. In addition, the City of San Marcos initiated sponsorship of a water resource improvement and recreational facilities along the San Marcos River. The Sponsors considered the impacts, both favorable and adverse, in developing a selected plan for meeting the project goals and also included measures to minimize adverse impacts wherever practicable. Since any viable project action depended on providing an acceptable level of protection in the urban area, NED Goal No. 1 was a component of each alternative. The use of different structural components or options in combination with the remaining goals served as the basis for formulating alternative plans.

PLANNED PROJECT [1]

Land Treatment Measures
(Going Program)

Inasmuch as conservation plans have been developed covering about 99 percent of the agricultural land in the watershed no specific goal for watershed protection was expressed by the Sponsors. Therefore, additional conservation land treatment was not considered as a necessary component to the Planned Project. It is estimated, however, that adequate conservation land treatment will be applied on about 9,300 acres concurrently with the five-year project installation period. The SCS field offices in San Marcos and New Braunfels will assist the Soil and Water Conservation District, under the authority of Public Law 46, in providing land users and operators with technical assistance on conservation land use programs.

Flood Plain Regulation

The City has enacted and is enforcing a zoning ordinance to regulate urban expansion in its area of jurisdiction below the 100-year flood elevation (Figure 1). Flood insurance is presently available in San Marcos. Annually, the City and the County will notify flood plain landowners and residents of flood hazards.

Structural Measures

Floodwater Retarding Structures

Five single purpose floodwater retarding structures will be constructed (Figure 2). The locations of the structures to be installed are shown on the Project Map (Appendix D).

Tables 1, 2, and 3 show details on quantities, cost, and design for each floodwater retarding structure.

The floodwater retarding structures will temporarily store or retard an average of 4.2 inches of runoff from 78.17 square miles of drainage area, or 82.3 percent of the watershed. The total storage capacity is 18,924 acre-feet, of which 17,922 acre-feet is for floodwater retardation and 1,002 acre-feet is for sediment storage. The structures will detain the runoff from a storm having a predicted recurrence interval of once in every 100 years (one percent chance storm). The structures are designed to store aerated sediment only in that no structure is expected to hold water for a significant period of time because of high infiltration rates into the Edwards Underground Reservoir. Crests of the

1/ All information and data, except as otherwise noted by reference to source, were collected during watershed planning investigations by the Soil Conservation Service, U.S. Department of Agriculture.

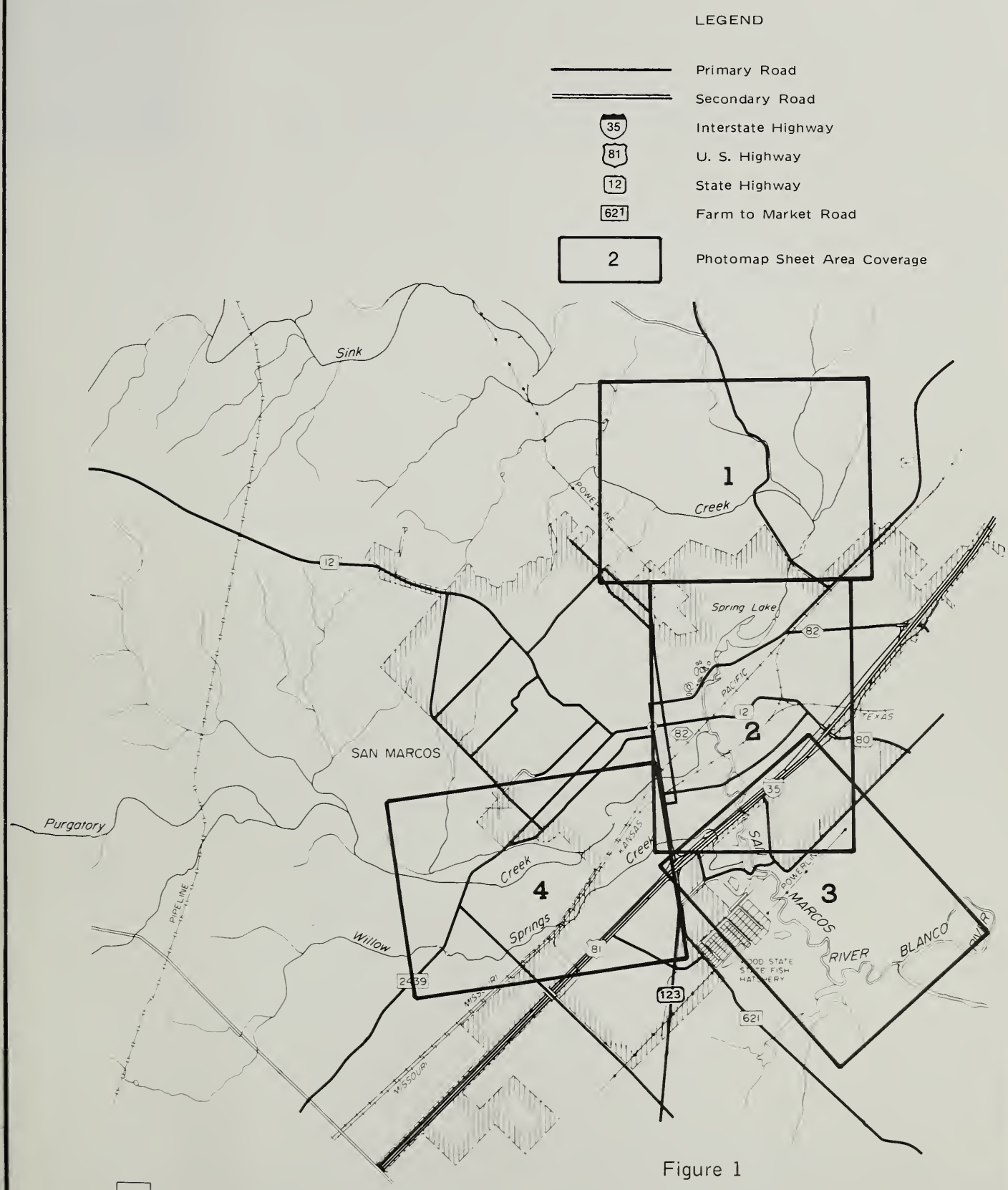


Figure 1

FLOOD PLAIN INDEX MAP

UPPER SAN MARCOS RIVER WATERSHED

HAYS AND COMAL COUNTIES, TEXAS

0 1 2

SCALE IN MILES

USDA-SCS-FORT WORTH, TEXAS 1977

WATER SURFACE ELEVATIONS AT VALLEY SECTIONS

Valley Section	100 Year Frequency	
	Without Project	With Project
S1A	610.7	597.8
S1+1	599.9	591.1
S1	591.0	586.0

USDA-SCS-FORT WORTH TEXAS 1977

WATER SURFACE ELEVATIONS AT VALLEY SECTIONS

Valley Section	100 Year Frequency	
	Without Project	With Project
A	586.3	582.0
B	584.4	579.3
C	581.1	574.3
D	580.1	573.5
I1	578.3	575.2
I2	578.3	570.6
F	573.2	562.0

USDA-SCS-FORT WORTH, TEXAS 1977

WATER SURFACE ELEVATIONS AT VALLEY SECTIONS

Valley Section	100 Year Frequency	
	Without Project	With Project
F	573.2	562.0
H	572.6	561.2
H1	571.0	559.1
H2	568.5	557.0
H3	563.9	553.2

USDA-SCS-FORT WORTH TEXAS 1977

WATER SURFACE ELEVATIONS AT VALLEY SECTIONS

Valley Section	100 Year Frequency	
	Without Project	With Project
J1	583.5	578.3
J2	583.5	577.3
W7	587.0	581.1
K+1	588.6	583.4
L	598.6	592.8
M	606.6	597.6
N	595.7	595.7
W10	598.5	598.5
W11	604.6	604.6
W12	606.5	606.5
W13	612.2	612.2

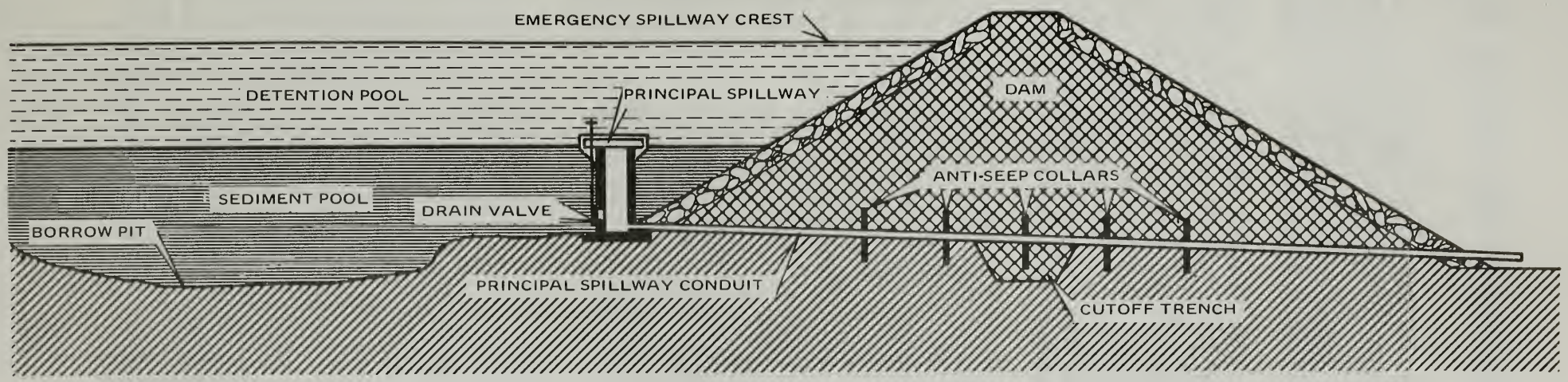


Figure 2

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

U. S. D A., SOIL CONSERVATION SERVICE
USDA-SCS-FORT WORTH, TEX. 1974

REV. 5-74 4-L-10071-E

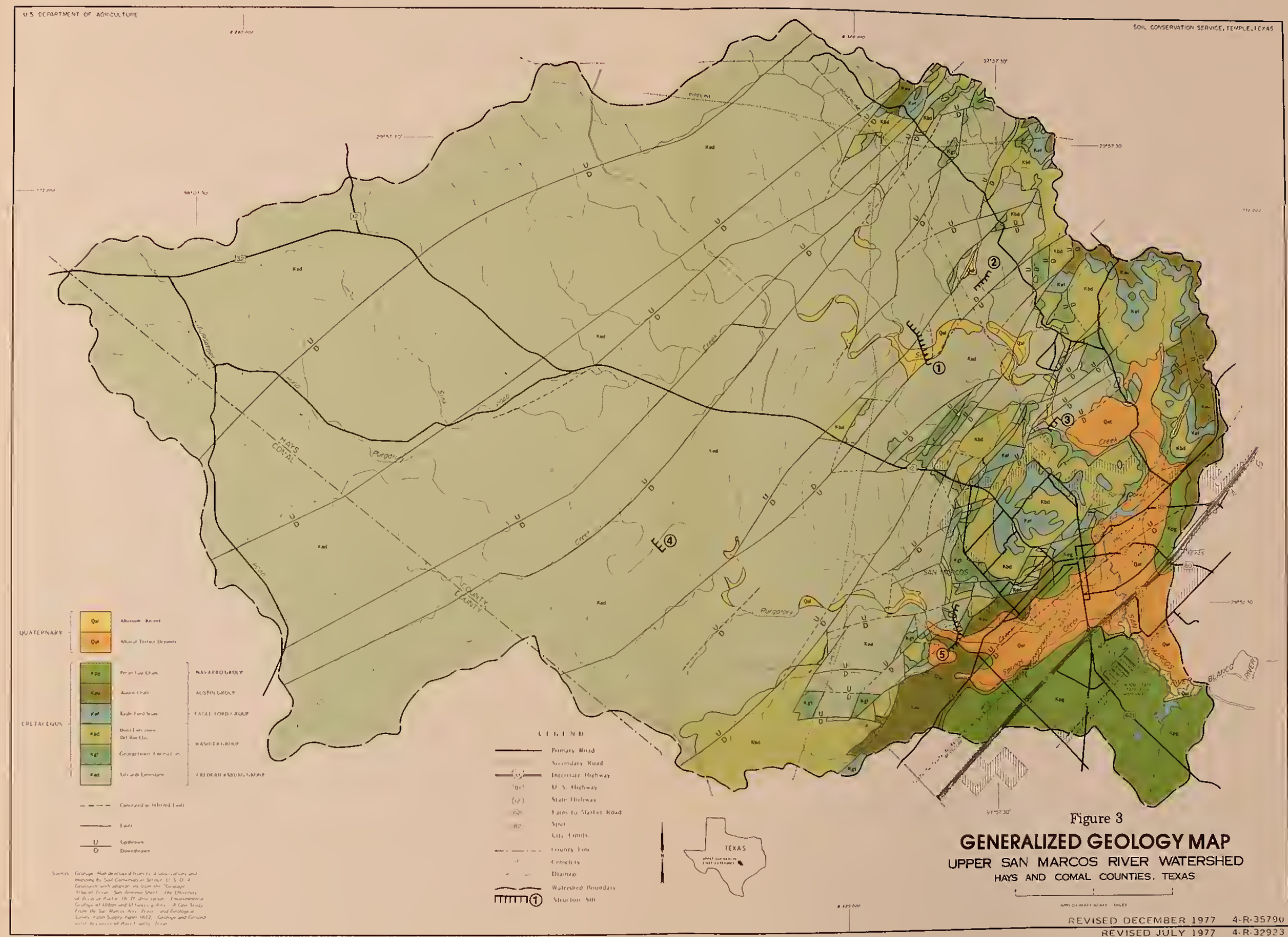
principal spillways will be installed at the elevation of the 100-year sediment pool.

All applicable state laws will be complied with in the design and construction of the structural measures as well as those pertaining to the storage, maintenance of quality, and use of water. Principal spillways will be ported at elevations which will limit potential water impoundments to 200 acre-feet including borrow.

Experience in design, construction, and functioning of floodwater retarding structures in the area has demonstrated that embankments at the five sites can be installed, will function as designed, and will maintain their structural integrity. Two design considerations expected are: (1) complete or partial rock blankets on the embankments, and rock excavation in the emergency spillway areas of the structures; and (2) lack of on-site fine-grained earth material for a center core of the embankment for Floodwater Retarding Structure No. 4.

Structure Nos. 2, 3, and 4 will have essentially rock-fill embankments with a center section or core of fine-grained, plastic earth material. Structure Nos. 1 and 5 will be earth fill (fine-grained, plastic material) with durable limestone rock blankets. Fine-grained, plastic material for the embankment cores can be obtained from the sediment and retarding pool areas of Structure Nos. 2 and 3. However, there is not an adequate volume of suitable embankment core material available on the site for Structure No. 4; therefore, auxiliary borrow areas have been designated downstream. Structure No. 1 also has a designated downstream borrow area to supplement fine-grained plastic material available in the sediment and retarding pools of this structure. All rock-fill materials will be obtained from the sediment and retarding pools and from excavation in the emergency spillway areas. Emergency spillway excavation ranges from 36 percent of embankment needs for Structure No. 1 to 89 percent of embankment needs for Structure No. 3. Structural details are presented on Table 3.

Preliminary geologic and soils investigations were made with power drilling equipment. More detailed investigations and appropriate laboratory analysis of soil and rock materials will be accomplished before final design and construction. The data obtained from these investigations will assist in determining the placement and type of embankment foundation drains, if needed, for controlling potentially excessive pore pressures, the depth and width of foundation cutoff trenches, shear strengths of embankment and foundation materials, consolidation characteristics, and other structural considerations. Structure Nos. 2 and 4 will be constructed on the Edwards Limestone formation (Figure 3). Structure Nos. 1 and 3, in addition to the Edwards Limestone, will have embankment foundation materials consisting of Quaternary alluvial clay, silt, sand, gravel, and cobbles with a few small boulders. Structure No. 5 embankment foundation will consist of Cretaceous Edwards Limestone, Georgetown Formation, Del Rio Clay, Austin



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Chalk; and Quaternary alluvial deposits. Generally, all Cretaceous and Quaternary strata have sufficient bearing capacities and shear strengths. It is anticipated foundation core trenches for Structure Nos. 1 and 3 will extend in depth through the Quaternary alluvial deposits to competent Edwards Limestone.

Floodwater retarding structure sites are located within the Balcones fault zone which is the dominant geological structure within the watershed. No active faults are known to exist in the watershed or surrounding areas of influence. The Algermissen Seismic Risk Map (based on the distribution of recorded damaging earthquakes) shows this area of Texas to be centrally located within Zone 0 which is defined as having no reasonable expectancy of earthquake damage. Therefore, seismic activity is not considered to be a problem in structure design.

Investigations during planning indicate the foundations of Structure Nos. 2, 3, and 4 are not affected by faulting. Embankment alignments of Structure Nos. 1 and 5 cross two or more faults (Figure 3). In these areas of faulted Cretaceous formations, there is greater potential for irregular rock surfaces in the foundations which would cause differential consolidation under embankment loadings. Special attention will be given to differential settlement problems during comprehensive core drill investigation, laboratory analysis of materials, final design, and construction phases of structure installation.

Due to the jointed, vugular, and in some cases faulted and cavernous nature of the embankment foundations at all sites, grouting may be needed. It is not expected that large amounts of grouting will be required. Details regarding locations and volumes will be determined, if needed, after the comprehensive core drill investigations.

Preliminary and present indications are that principal spillways for all structures can be located on noncompressible foundations. Principal spillways will have monolithic, rectangular, reinforced concrete inlets and prestressed concrete-lined, steel cylinder pipe outlet barrels, except Structure Nos. 3 and 5 which will have monolithic, rectangular, reinforced concrete barrels. Rock or concrete-lined plunge basins are included in preliminary details. Structural details will be treated in the final design phase.

Sediment pool capacities range from 93 acre-feet to 304 acre-feet (Table 3). Sediment storage requirements were determined by applying delivery ratios ranging from 37 to 52 percent to gross erosion expected to occur on the drainage area above the structure sites. Sediment yield was adjusted for trap efficiency of the structures and then allocated to the sediment pool and detention pool. In determining storage capacities, volume weights used for sediment ranged from 80 to 82 pounds per cubic foot.

It is anticipated that the emergency spillways for all structures will be in erosion resistant rock at finished grade. Each floodwater retarding structure provides a one percent chance, or less, of emergency spillway use.

It is anticipated that components of the floodwater retarding structures will be excavated in rock or protected by rock blankets. Should on-site features indicate that revegetation is possible, a combination of multiple-use plants, adapted to prevailing conditions be established for erosion control and wildlife food and cover. This will be determined on a site by site basis during construction. The type of vegetation to be used will be perennial vegetation of native and introduced grasses and forbs. Plant species will be selected, sited, and planted in accordance with SCS Technical Specifications for Establishment of Wildlife Habitat on or Adjacent to Watershed Works of Improvement. These plantings will be sited and planned in detail during the final design stage in consideration of specific site conditions. The selection of exact species to be used will be from the adapted species of seed and plant stock available at the time of construction.

The structures will be surrounded by rugged bluffs and steeply rolling hills. Vegetation adjacent to the structures consist of limited stands of ashe juniper 1/ and live oak, native savannah, improved pasture, seeded areas, and some field crops. Where feasible, cut slopes will be blended with existing topography. Every effort will be made to lessen the visual impact of structural measures by using existing natural vegetation for screening.

The land where the floodwater retarding structures are to be located is privately owned. Since the purposes of these structures are for sediment control and floodwater retardation, land rights for the five floodwater retarding structures will not be acquired for recreational purposes. Sponsors at the present time do not intend to provide public access; therefore, public recreational use will not be permitted. If at some future time public access is provided, the Sponsors have given assurance that adequate sanitary facilities meeting local and state health standards will be installed prior to public use.

Installation of the five floodwater retarding structures will require 1,401 acres of rangeland (excluding flowage easement and auxiliary borrow areas). The construction of dams and emergency spillways will require 160 acres. The sediment pools at the lowest ungated outlet will inundate 104 acres. Installation of the structures will destroy, alter, or inundate approximately 2.9 miles of natural ephemeral stream channel. Flowage easements will be obtained on 88 acres of rangeland immediately below the spillway of Structure Nos. 1, 2, 4, and 5. Auxiliary borrow areas may be needed on 36 acres of rangeland downstream from Structure Nos. 1 and 4.

1/ Plant names are referenced to SCS's National List of Scientific Plant Names, and Scientific and Standardized Common Names of Plants of Texas, Advisory PLANT SCIENCE TX-6.

As planned, 346 acres will be cleared of existing woody vegetation for construction and proper functioning of the five floodwater retarding structures (Figures 4 through 9). Inasmuch as these structural measures are not expected to impound water, it will not be necessary to clear the sediment pool to the lowest ungated outlet of woody vegetation.

The minimum land rights required will be those necessary to construct, operate, maintain, and inspect floodwater retarding structures. Installation of the floodwater retarding structures may require changes in location or modification of known existing facilities as follows:

Site No. 1 - Pipeline, powerline, fences, corral, water well, water storage facility and trough
Site No. 2 - Powerline
Site No. 3 - Fences, powerline, and county road
Site No. 4 - None
Site No. 5 - Fences, powerline, and Farm Road 2439

All costs for necessary changes in location or modifications as listed above are land rights costs and will be borne by the Sponsors.

There will be no apparent displacements or relocations of persons, businesses, or farm operations as a result of installation of the floodwater retarding structures. If relocations or displacements become necessary, they will be carried out under the provisions of Public Law 91-646, Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

Water Resource Improvement

A water resource improvement consisting of side inlets, earth shaping, sodding, and streambank protection for maintaining the quality of the recreational facilities will be installed along selected portions of the San Marcos River (Figure 10). Two side inlets will be constructed at existing drainageways in order to better convey storm runoff from the roadbed of the MKT railroad and adjoining parkland. Additional earth shaping south of the railroad trestle will be required to protect the area from increased foot traffic. The disturbed area will be sodded to suitable grass species that are able to withstand abuse from increased recreation pressure and protect the streambank from potential erosion. Vegetation will be established on other areas to benefit the visual resource of the river and protect selected areas of unique aquatic habitat from human encroachment. The use of native plant species will be encouraged.

The SCS will design the water resource improvement and provide this design to the A&E consultant. This design will be incorporated into the final design and siting of the recreational facilities.

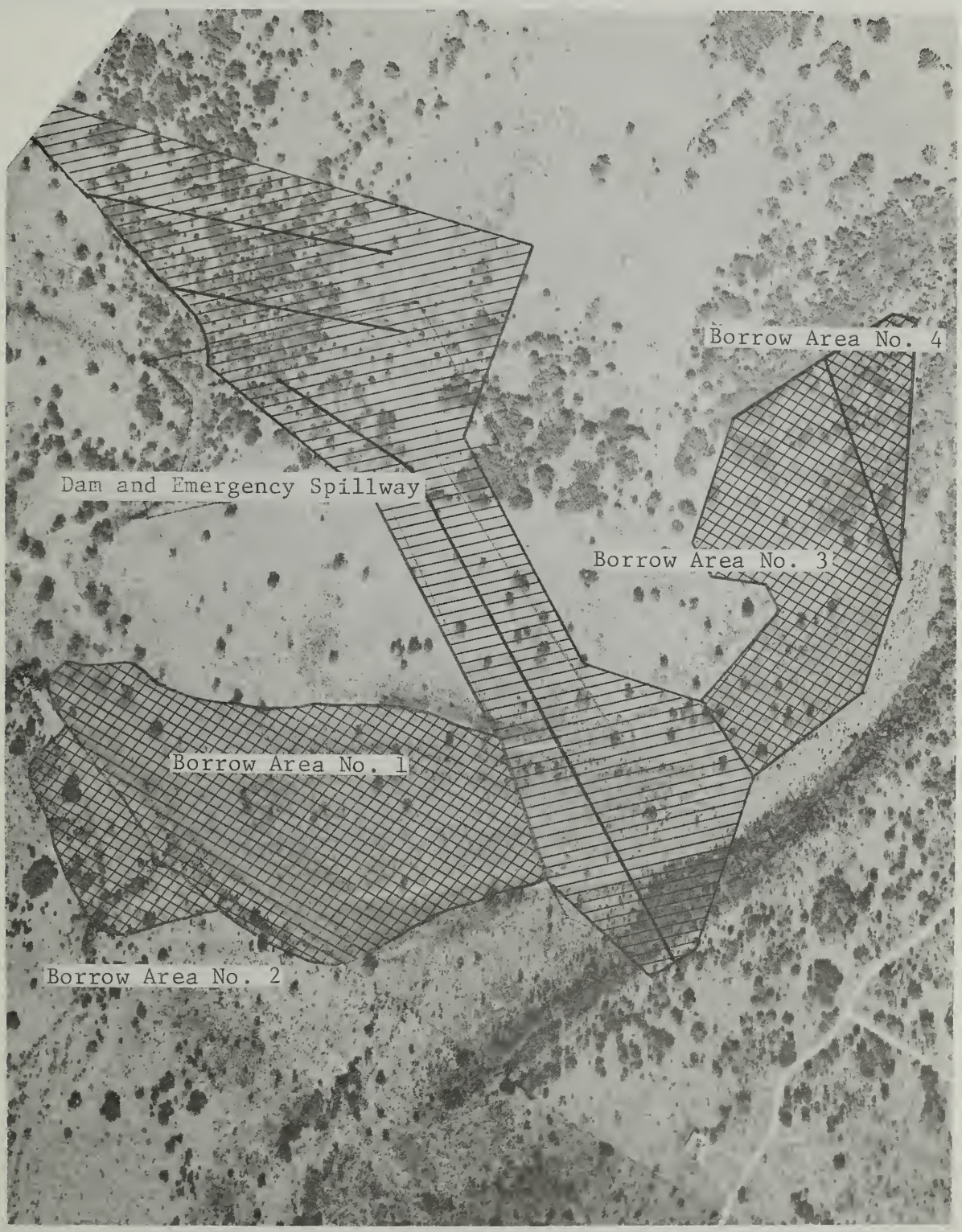
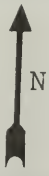


Figure 4 - UPPER SAN MARCOS RIVER WATERSHED
Floodwater Retarding Structure
Site No. 1 - 124 Ac. planned to be
cleared of existing woody vegetation
Approximate Scale: 1" = 660'



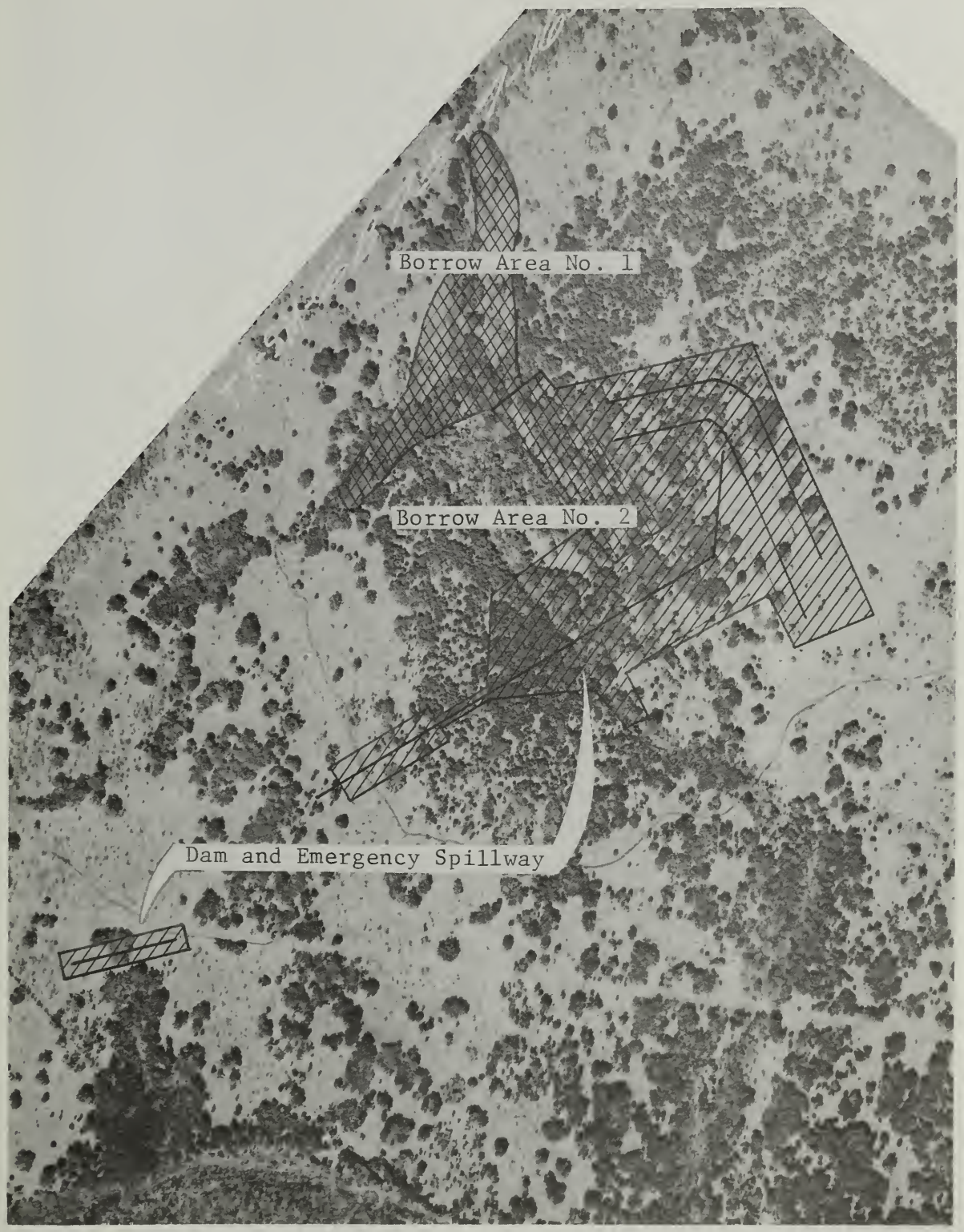


Figure 5 - UPPER SAN MARCOS RIVER WATERSHED
Floodwater Retarding Structure
Site No. 2 - 45 Ac. planned to be
cleared of existing woody vegetation
Approximate Scale: 1" = 660'

N

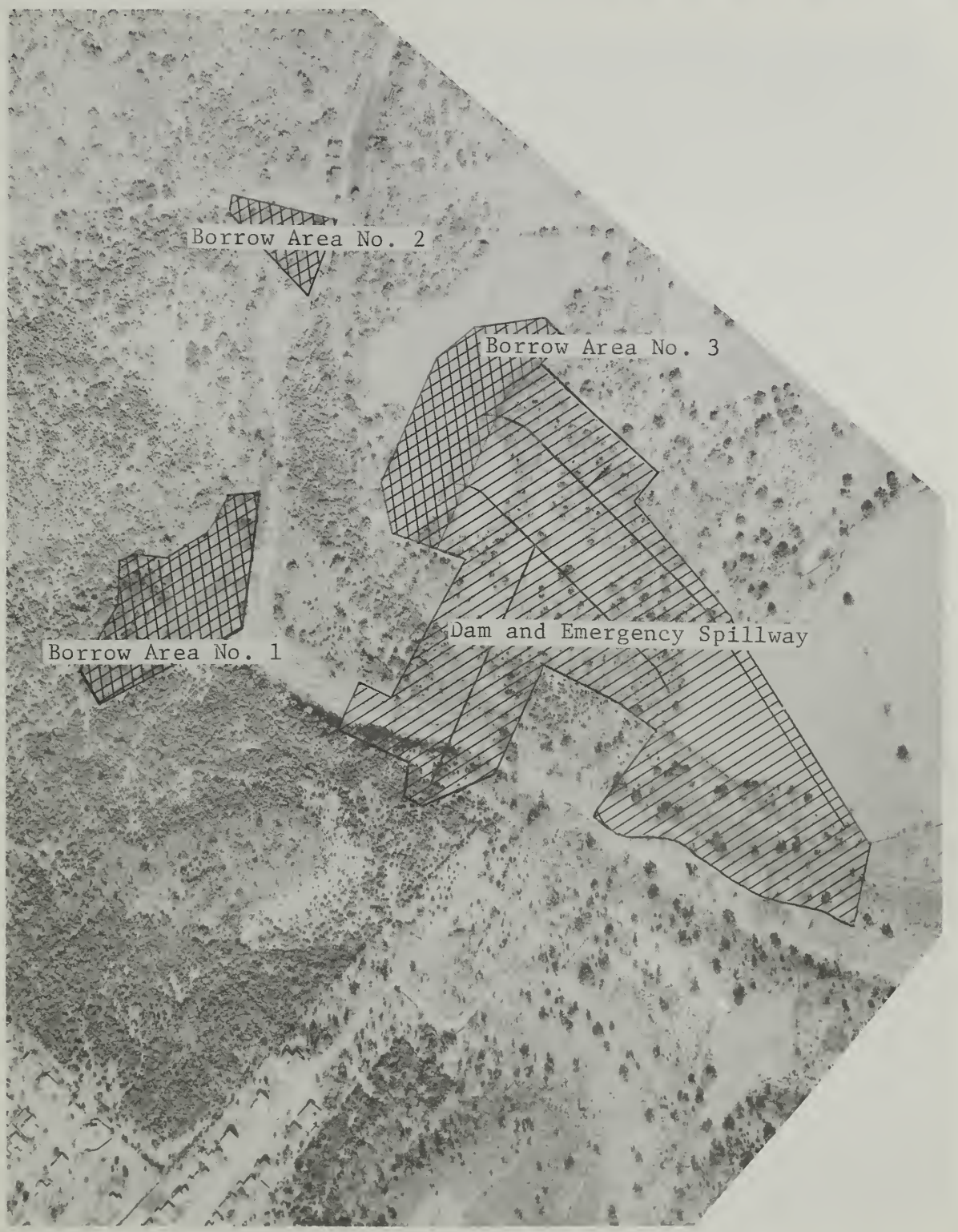


Figure 6 - UPPER SAN MARCOS RIVER WATERSHED
Floodwater Retarding Structure
Site No. 3 - 61 Ac. planned to be
cleared of existing woody vegetation
Approximate Scale: 1" = 660'

N

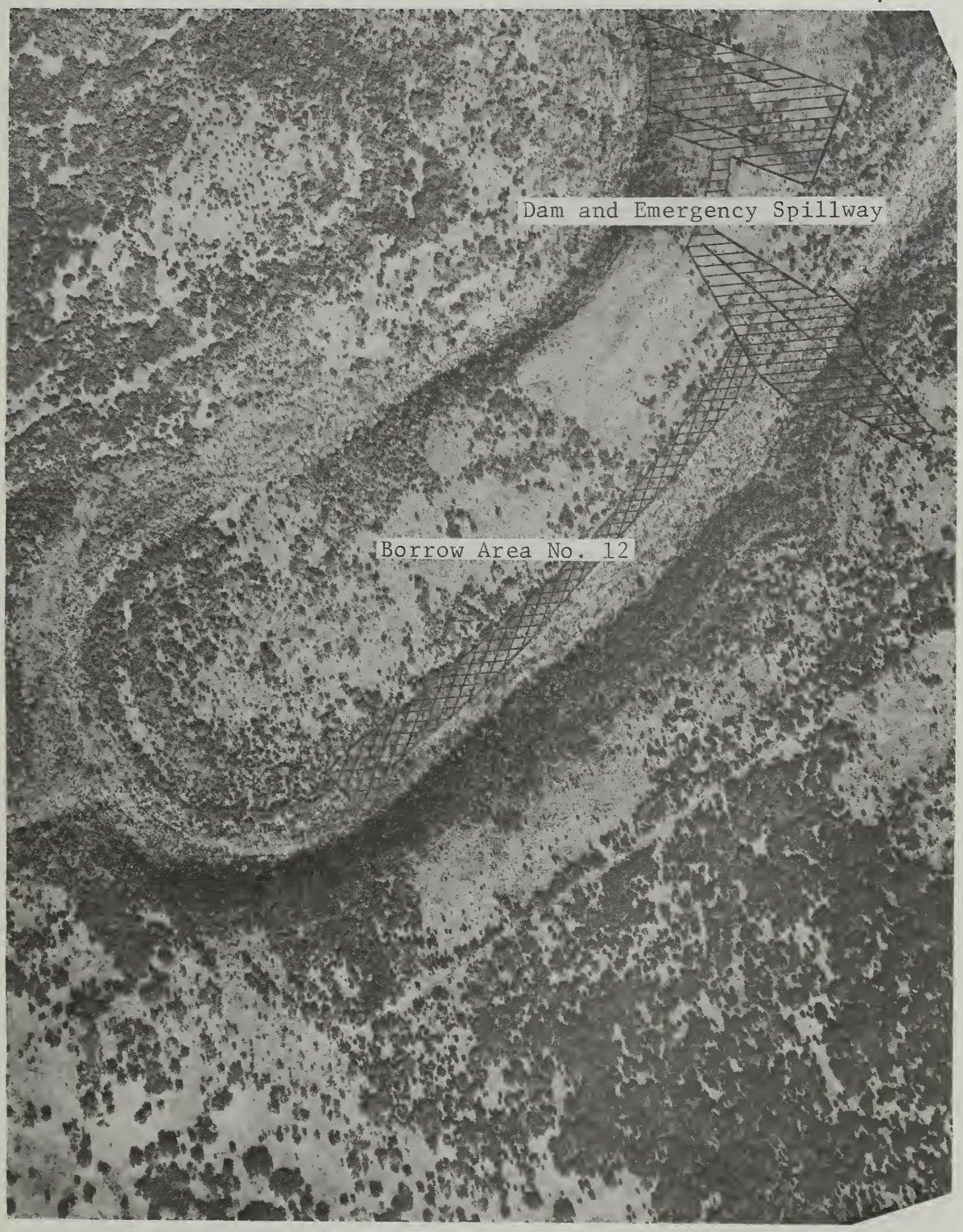


Figure 7 - UPPER SAN MARCOS RIVER WATERSHED
Floodwater Retarding Structure
Site No. 4 - 23 Ac. planned to be
cleared of existing woody vegetation
Approximate Scale: 1" = 660'

N

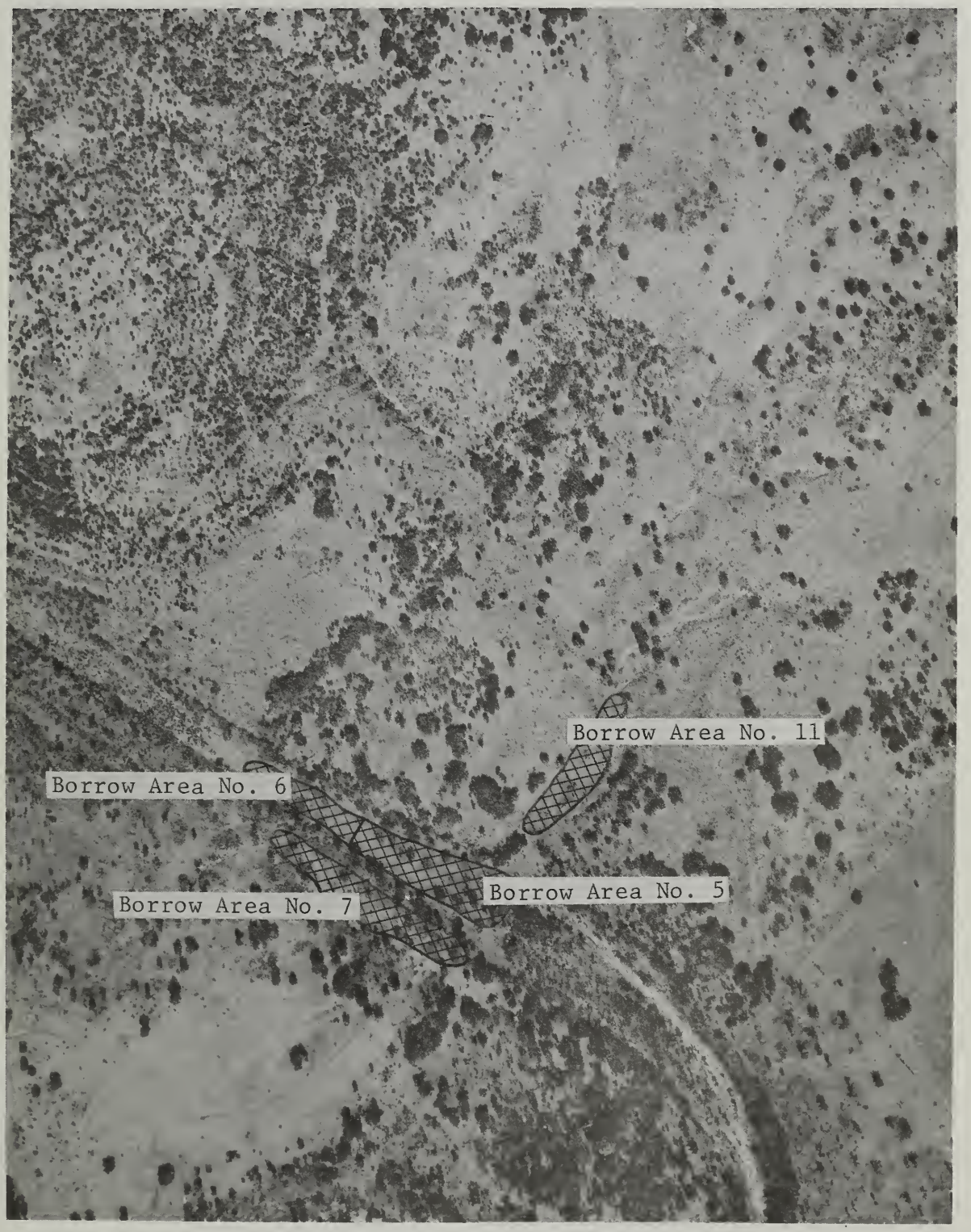


Figure 8 - UPPER SAN MARCOS RIVER WATERSHED
Floodwater Retarding Structure - Site No. 4 -
8 Ac. of auxiliary borrow areas planned to
be cleared of existing woody vegetation
Approximate Scale: 1" = 660'

N

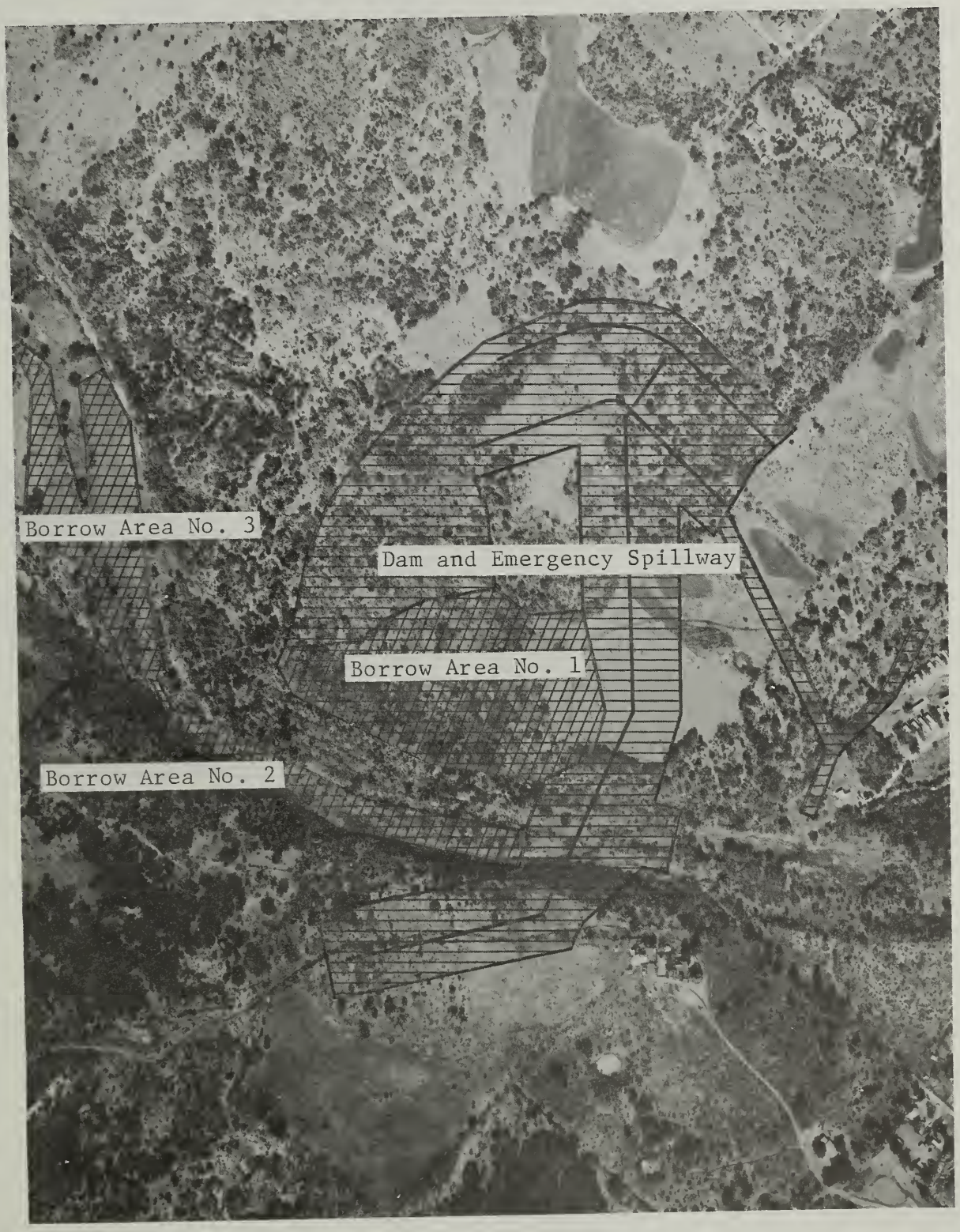


Figure 9 - UPPER SAN MARCOS RIVER WATERSHED
Floodwater Retarding Structure
Site No. 5 - 85 Ac. planned to be
cleared of existing woody vegetation
Approximate Scale: 1" = 660'

N

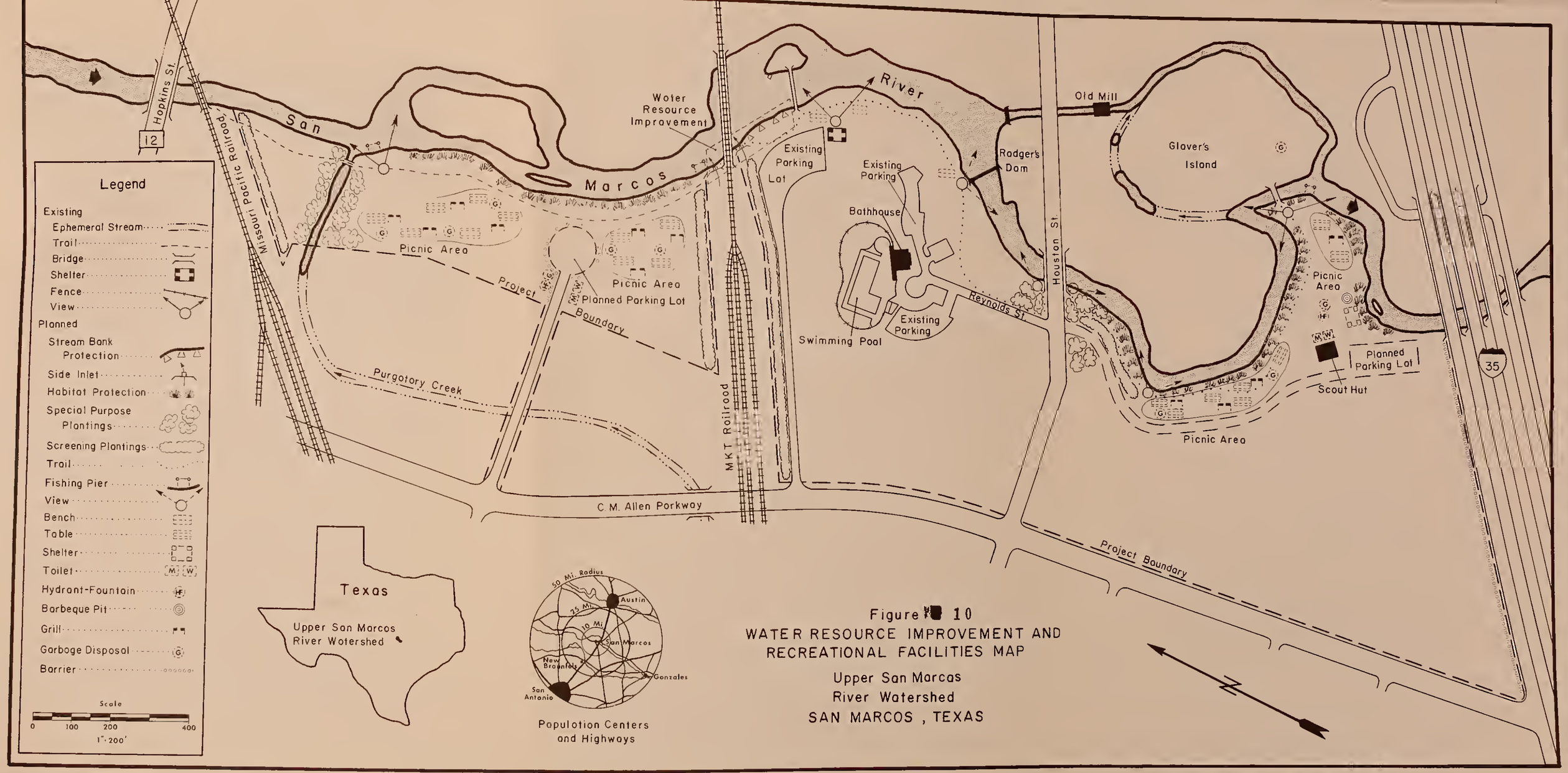


Figure 10
WATER RESOURCE IMPROVEMENT AND RECREATIONAL FACILITIES MAP
Upper San Marcos River Watershed
SAN MARCOS, TEXAS

Recreational Facilities

Public water-based recreational facilities will be installed along the San Marcos River on portions of parkland owned or controlled by the City (Figure 10). A comprehensive recreation and landscape plan was prepared by the Department of Landscape Architecture, Texas A&M University, to insure proper placement of facilities in accordance with ecological and developmental criteria.

Recreational facilities, unless otherwise noted, will meet the requirements of Senate Bill 111, Standards and Specifications for the Construction of Public Buildings and Facilities in the State of Texas Usable by the Physically Handicapped and Disabled Citizens, and any Federal standards applicable.

Basic recreational facilities that are to be installed consist of picnic sites, group shelters, restrooms, and fishing piers. Accessory items to these facilities include trash receptacles, cooking grills, drinking fountains, parking areas, additional roads and road rehabilitation, traffic barrier posts to confine vehicular traffic to roads and other designated areas, and improved utility systems. Also to be installed is a series of nature and hiking trails and foot bridges. Proposed restrooms and parking spaces are intended primarily for users of picnic areas and related facilities. Restrooms will be served by municipal sewer and water systems.

The restrooms will be located in areas that are subject to flooding without project conditions. To comply with the Flood Disaster Protection Act of 1973 (Public Law 93-234) the following conditions will be met: (1) Constructed of material that will not be damaged by floodwater; (2) Able to withstand the hydrostatic pressures of the floodwaters without collapsing, and not become an impediment to the flood flow; (3) Sanitary facilities equipped with check valves to prevent sewage effluent from backing out of the sewage lines; and (4) A building permit obtained from the City.

Structures for water control will be used to convey surface water under park roads without causing erosion damage. These structures are considered a part of the park road system to be constructed.

Landscaping in the park will consist of shrub and tree plantings to screen existing facilities and beautify entrances and roads. Additional landscape material will be used to enhance wildlife habitat and protect unique aquatic habitat from encroachment.

Environmental Construction Requirements

All construction activities directly affecting the Edwards Underground Reservoir will be mandated by the provisions contained in the Texas Department of Water Resources Rules, Chapter 20. Construction contracts will require contractors to adhere to strict standards complying with U.S. Department of Agriculture, Soil Conservation Service Engineering

Memorandum 66, "Guidelines for Minimizing Soil Erosion and Water and Air Pollution During Construction." Measures to control erosion will be specified at the work site and will include, as applicable, use of temporary vegetation, mulches, diversions, mechanical retardation of runoff, and sediment traps. Harmful dust and other pollutants inherent to the construction process will be held to minimum practical limits. Provisions will be made to protect against pollutants such as fuel, lubricants, and chemicals. Clearing and disposal of brush and vegetation will be carried out in accordance with applicable laws, ordinances, and regulations.

In conformance with Federal, state, and local water pollution control regulations, sanitary facilities will be established to reduce pollution hazard. Special provisions in the construction contract will be incorporated by reference to "Safety and Health Regulations for Construction, Part I and Part II," U.S. Department of the Interior, Bureau of Reclamation.

One of the first collecting points of the endangered Texas blind salamander was from Johnson's Well. This was a hand-dug well with masonry sides and occurs just outside the downstream toe of the dam of Floodwater Retarding Structure No. 5. The well is no longer functional because it has filled with sediment. This well is of natural historic significance and will be protected and kept intact during construction.

Intensive field surveys of the land to be occupied by the floodwater retarding structures were conducted by personnel of the Texas Archaeological Survey, The University of Texas at Austin. SCS archeologists completed a similar survey of cultural resources in the location of the water resource improvement and recreational facilities. It was determined that the structural measures would affect a total of 17 archeological sites. A plan for mitigation will be implemented and further work be undertaken prior to beginning construction activities at those sites. Three of those archeological sites are eligible for inclusion in the National Register of Historic Places and will be mitigated or preserved prior to construction as follows:

1. Site 41HY75 located at Floodwater Retarding Structure No. 1 will be definitively mapped, and broadly collected and dated.

2. Site 41HY86 located at Floodwater Retarding Structure No. 2 will be protected and kept intact during construction.

3. Site 41HY92 located at Floodwater Retarding Structure No. 3 will be extensively tested and sampled.

Mitigation will be accomplished under the direction and supervision of a qualified archeologist with the concurrence of the State Historic Preservation Officer. The sections of this document dealing with ENVIRONMENTAL SETTING, ENVIRONMENTAL IMPACT, and ALTERNATIVES should be reviewed for additional details.

If any previously unidentified evidence of cultural values are discovered during detailed investigations or construction, the procedures in Public Law 93-291 will be followed. There will be no change in the existing responsibilities of the SCS under Executive Order 11593. Mitigation will be accomplished as set forth in Title 7, Code of Federal Regulations, Part 656, "Procedures for the Protection of Archeological and Historical Properties Encountered in SCS-assisted Programs."

Operation, Maintenance, and Replacement

Land Treatment

The operation and maintenance of applied conservation land treatment under the going program will be essentially the responsibility of land users. District Cooperators agree to maintain all applied conservation practices which are installed with technical assistance from the SWCD. Technical assistance will be provided to land users to maintain applied conservation practices. The SWCD will make periodical field inspections of the watershed and maintain personal communications with land users to determine the status of applied land treatment.

Structural Measures

The County will be responsible for operation and maintenance of the floodwater retarding structures. Cost of operation and maintenance for the five floodwater retarding structures is estimated to be $980 annually. Monies for operation and maintenance will be supplied from the general fund of the County. This fund is supported by tax revenue. Each year the County will budget sufficient funds for the operation and maintenance responsibilities.

For a period of three years, the floodwater retarding structures will be inspected at least annually and after each heavy rain by representatives of the County, the SWCD, and the designated SCS representative.

Upon completion of each floodwater retarding structure, the County will assume responsibility for operation and maintenance of the structure. The County or their representative will perform promptly all maintenance of the structures as determined to be needed by either the Sponsors or the SCS, including that required to prevent soil erosion and water pollution. Trash racks on each principal spillway will require occasional maintenance to keep them in proper working condition. Bent and damaged grill work will be straightened or replaced.

The City will be responsible for operation and maintenance of the water resource improvement at an estimated annual cost of $250. In addition, the City will be responsible for operation, maintenance, and replacement of the recreational facilities at an annual cost of $17,280. These costs include custodial, policing, sanitation, safety, and an allowance for replacement. Annual replacement costs are estimated to be $2,500.

The City will be responsible for replacement or major renovation of each item to insure the continued integrity of the recreational facilities for the planned life of the project (100 years). Existing vegetation along the San Marcos River will be maintained and not disturbed except for occasional replacement with better adapted species. Newly planted landscape material (screening, wildlife cover, and habitat protection) will be watered and fertilized as necessary to assure establishment and maintenance. As a safety precaution, the City will close the park area to the public during flood stage.

For a period of three years, inspection of the water resource improvement and recreational facilities will be made annually by the City and the SCS. Annual inspections after the third year will be made by the City and a report furnished to the SCS. After the third year, the SCS will make additional inspections periodically as deemed necessary.

A specific operation and maintenance agreement will be prepared for each structural measure and will be executed prior to signing a project agreement. The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with Public Law 566 financial assistance. The agreement will set forth specific details on procedures in line with recognized assignments of responsibility and will be in accordance with the Texas Watersheds Operation and Maintenance Handbook.

Sponsors will also control the handling, use, and application of any herbicides and pesticides that may be needed for operation and maintenance of structural measures. If the use of chemicals should be required, only approved and authorized reagents and compounds will be used. Their application will be compatible with current laws regulating their use. In addition to prudent judgment, ordinances and standards concerned with the disposal of storage of unused chemicals, empty containers, contaminated equipment, etc. will be observed and applied.

The SCS will participate in operation and maintenance only to the extent of furnishing technical assistance necessary for the operation and maintenance program.

Provisions will be made for unrestricted access by representatives of the Sponsors and SCS to inspect all structural measures and their appurtenances at any time and for the Sponsors to perform operation and maintenance. Easements insuring this unrestricted ingress and egress will be furnished by the Sponsors.

The County and the City will maintain a record of all maintenance inspections performed, maintenance applied, and cost of such maintenance and have it available for inspection by SCS personnel.

The necessary maintenance work will be accomplished by contracts, force accounts, or equipment owned by the Sponsors.

Project Costs

The estimated costs for installation of the project are presented in the following tabulation:

Item	Estimated Cost (Dollars) 1/		
	Public Law 566	Other	Total
Total Project	4,447,270	1,464,590	5,911,860
(Construction)	(3,637,040)	(78,610)	(3,715,650)

1/ Price Base: 1976

ENVIRONMENTAL SETTING

Physical Resources

Location and Size

The Upper San Marcos River Watershed drainage area is 95 square miles (60,780 acres), has an average width of 8 miles, and is about 12 miles long. The watershed is located in South Central Texas in portions of Comal and Hays Counties, and is about 30 miles southwest of Austin and 50 miles northeast of San Antonio. Sink Creek, the largest contributing drainageway, heads in southern Hays County. As it enters the city limits of San Marcos, it joins with San Marcos Springs to form Spring Lake and the headwaters of the San Marcos River. The San Marcos River heads from numerous springs at the base of the Balcones Escarpment within the city of San Marcos. Purgatory Creek heads in extreme southern Hays County and northeastern Comal County. This creek also flows to its confluence with the San Marcos River in the City's parkland about 500 feet south of the Ranch Road 12 (Hopkins Street) crossing. Willow Springs Creek is the smallest principal tributary of the San Marcos River. Willow Springs Creek originates about four miles west of San Marcos and joins the San Marcos River just below Interstate 35. The San Marcos River flows in a southeasterly direction from Spring Lake for about 4.5 miles to its confluence with the Blanco River. The river then flows southeasterly for about 70 miles to its confluence with the Guadalupe River just south of Gonzales. The San Marcos River, a part of the Guadalupe River Basin, is in the Texas Gulf Water Resource Region.

Major Problem Areas

The major problem is flooding along the San Marcos River and its three major tributaries, Sink, Purgatory, and Willow Springs Creeks. This flooding results in damages to residences, businesses, public buildings,

agricultural properties, city streets, automobiles, etc. Human lives have been lost from floods. There is a need for a water resource improvement and additional public water-based recreational facilities.

Geology and Geohydrology

The stratigraphy, structure, geomorphology, and ground water conditions of the watershed and related areas have been studied intensively by numerous investigators. Among these are students from The University of Texas at Austin, and geologists and hydrologists with the Texas Water Development Board and the United States Geological Survey. The City of San Antonio and The Edwards Underground Water District have also cooperated with Federal and state agencies and academic institutions in accomplishing many of the geologic and related studies.

Geologic outcrops in the watershed are Recent and Cretaceous age sedimentary strata as indicated on Figure 3 and Chart 1. Regionally, the Creataceous strata dip gently to the southeast. Locally, however, within the Balcones fault zone, where crustual movement has been severe, the dip is drastically increased and in some isolated cases, it has been reversed to the northwest.

The Balcones fault zone is the dominant geological structure in the watershed and vicinity. It is a system of northeastward trending step faults with upthrown sides generally on the northwest. The entire Balcones fault zone extends more than 200 miles from west of Uvalde eastward to San Antonio and then northeastward to the vicinity of Georgetown in Williamson County. A vast ground-water reservoir lies beneath the surface in the fault zone. This reservoir is most significant in parts of Kinney, Uvalde, Medina, Bexar, Comal, and Hays Counties where it is known as the Edwards Underground Reservoir (Figure 11). This unique limestone aquifer and its ability to provide high quality and large quantities of municipal, industrial, agricultural, and rural domestic water have been the focal points of most of the studies and investigations previously mentioned. De Cook (1963) has concluded that the Edwards Underground Aquifer in Hays County is comprised principally of the Edwards Limestone. This is in contrast to the areas to the south and west where the Georgetown Formation is included as an integral part of the aquifer. The Edwards Limestone, and the Georgetown Formation (where it is considered to be part of the aquifer) have undergone considerable solution. In the fault zone where these limestone beds are highly fractured, a large intricate system of interconnected cavities and caverns exist.

About 90 percent of the Upper San Marcos River Watershed is located over the Edwards Underground Reservoir. Streams that flow over the Edwards Limestone and the fault zone are the major source of ground-water recharge in the vicinity of the watershed. This is the conclusion of Pearson et al. (1975) after studying the tritium concentrations throughout the Edwards Underground Reservoir. It should be noted, as evidenced

EXPOSED GEOLOGIC STRATA
Chart 1

System	Series	Group	Formation	Lithology of Outcrop	Approximate Thickness in Watershed Vicinity - feet
Quaternary	Recent	-	Alluvium	Clay, silt, sand, gravel, cobbles, and limestone boulders	3-10
"	Pleistocene	-	Alluvial terrace	Fluviatile clay, silt, sand, and gravel	3-30+
Cretaceous	Gulf	Navarro	Pecan Gap Chalk	Chalk and chalky marl, weathers light gray and white	200
"	"	Austin	Austin Chalk	Chalk and marl, mostly microgranular calcite, light gray	170
"	"	Eagle Ford	Eagle Ford Shale	Shale, compact, gray upper and lower parts; middle part very calcareous, flaggy, fine grained sandstone	25
"	Comanche	Washita	Buda Limestone	Limestone, massive, fine grained, poorly bedded, light gray to pale orange	50
"	"	"	Del Rio Clay	Mostly clay with lesser amounts of calcareous siltstone, gypsiferous, medium gray, weathers to yellowish gray, Exogyra arientina Roemer abundant	40-50
"	"	"	Georgetown	Limestone, fine-grained, argillaceous, hard, brittle, light gray	30-40
"	"	Fredericks-burg	Edwards Limestone	Limestone, dolomite; limestone crystaline to fine grained, thin bedded to massive, hard and brittle; dolomite very fine grained; chert nodules and plates common in some beds, other beds devoid of chert; recrystalization, caverns, and honeycomb-	480±

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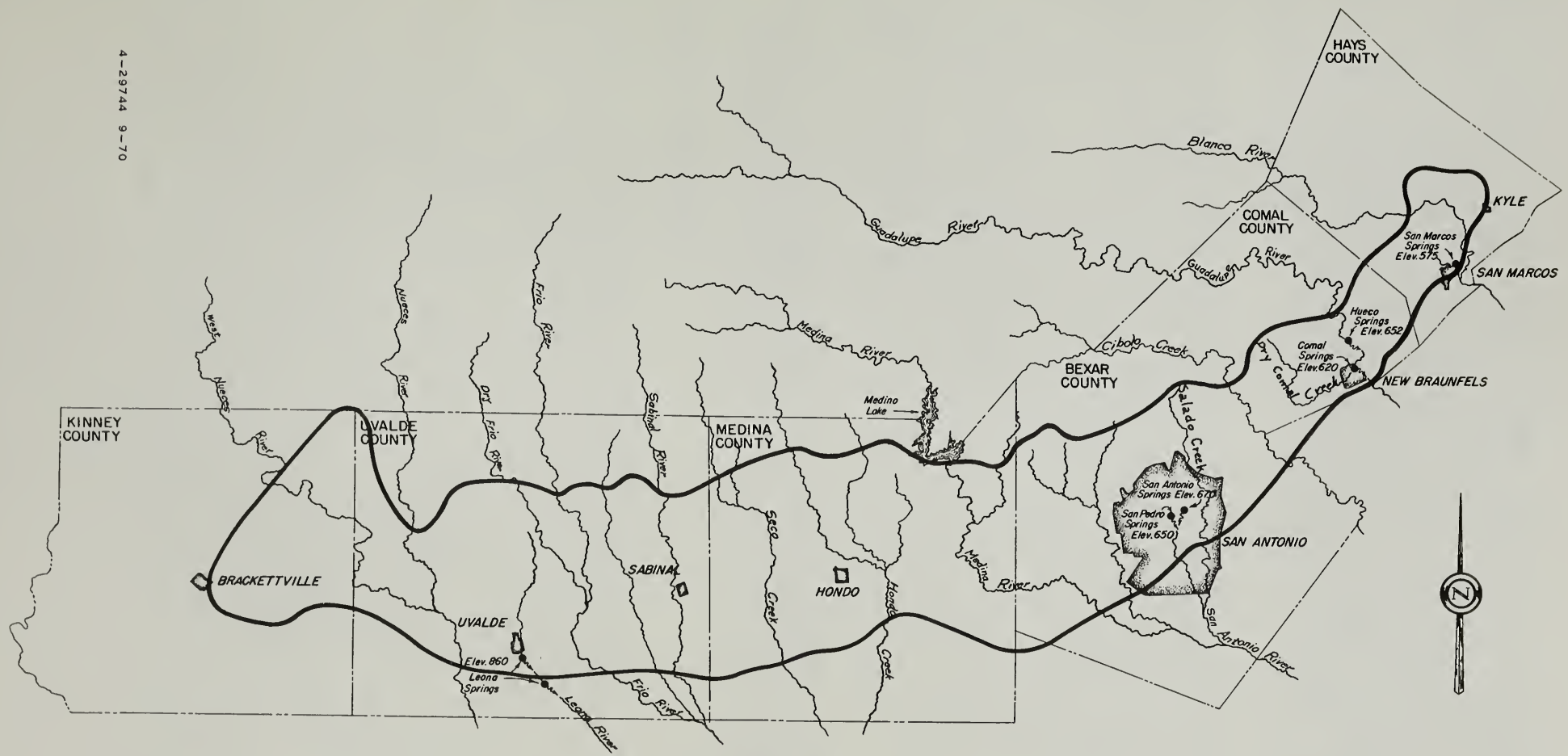


Figure 11

EDWARDS UNDERGROUND WATER RESERVOIR

LEGEND

BOUNDARY OF EDWARDS RESERVOIR

SPRING

Map Courtesy of Edwards Underground Water District

during the drought of the middle 1950's when all springs ceased to flow except San Marcos Springs, that a significant volume of "underflow" from the southwest contributes to local recharge. Puente (1976) also reached this conclusion after a comprehensive study and statistical analysis of water level, spring flow, and streamflow data from wells and stream gages. Rains of low to moderate intensity, falling on the Upper San Marcos River Watershed above the city of San Marcos, contribute much of their volumes to the porous and faulted Edwards Limestone. High intensity rains effect flood flows which greatly exceed the infiltration capacity of Edwards Limestone.

Natural outlets of significance for ground water within the watershed are Purgatory Creek Springs, Sink Spring, and San Marcos Springs. Purgatory Springs are located in the upper end of Purgatory Creek. Discharge from these springs flows downstream about 0.25 mile where it is impounded by a series of small privately owned dams. Sink Spring, located about 0.75 mile northeast of San Marcos Springs, flows to the surface where the discharge is impounded and eventually pumped to supply water for Bollman Industries. San Marcos Springs discharges from five large fissures and numerous smaller crevices in the Edwards Limestone (Puente 1976). The maximum recorded discharge of San Marcos Springs was 316 cubic feet per second on June 12, 1975; a minimum discharge of 46 cubic feet per second was recorded August 15-16, 1956; and the mean discharge from 1956 to 1975 is 166 cubic feet per second.

Ground water obtained from wells in the Edwards Underground Reservoir supply water for municipal, industrial, rural domestic, and livestock uses. Currently, there is no irrigation of crops in the watershed, but during the 1950's irrigation water was pumped from the Edwards Aquifer.

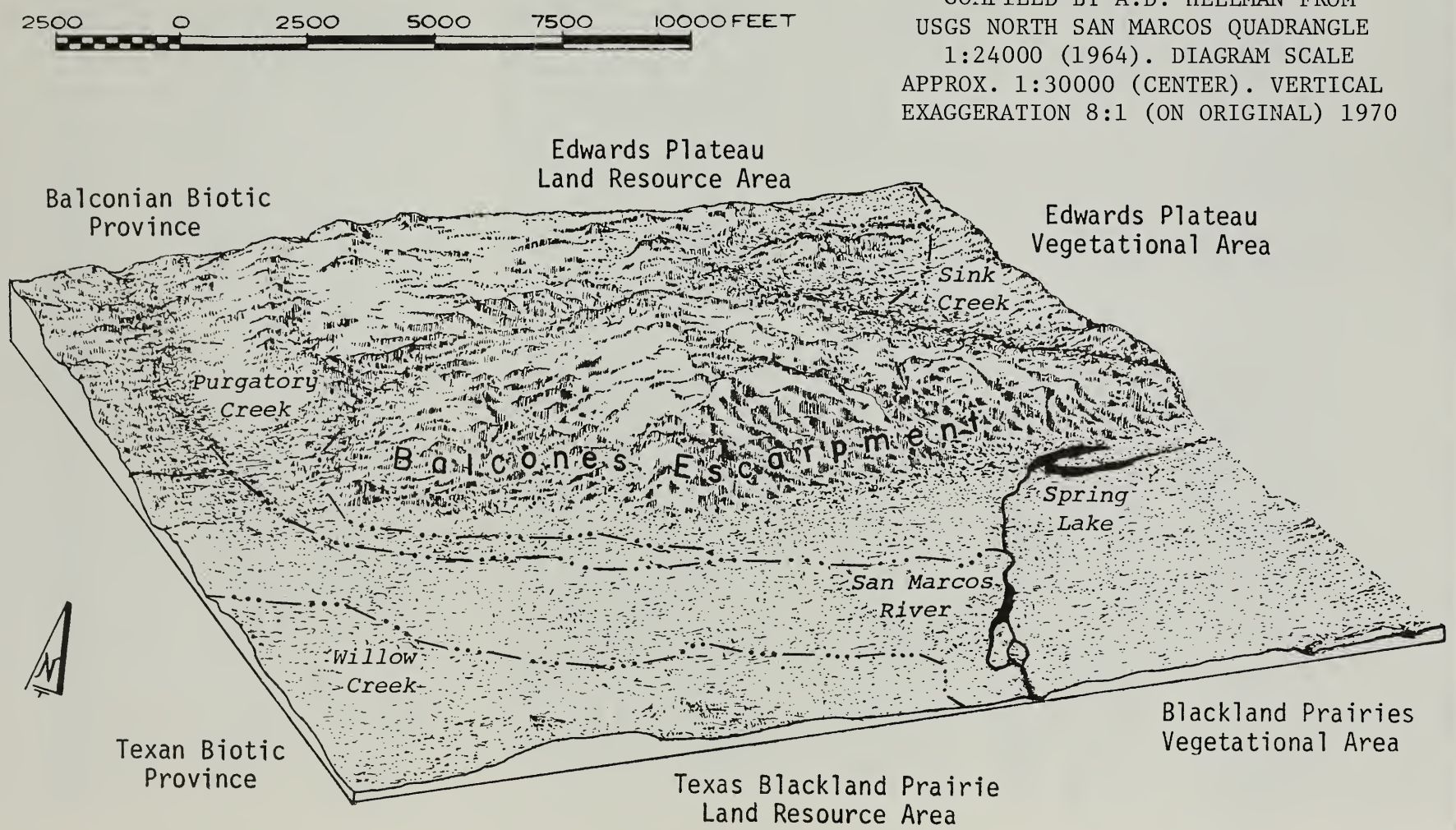
Topography and Elevation

In addition to being the major geological structure in the watershed area, the Balcones fault zone is expressed topographically as the Balcones Escarpment which separates two major land resource areas (Figure 12). The Edwards Plateau Land Resource Area lies to the north and west of the fault zone and comprises about 90 percent of the watershed. The Texas Blackland Prairie occupies the remaining 10 percent of the watershed on the south and east of the fault zone. Most of the landscape on the Edwards Plateau is gently undulating to steeply sloping uplands. However, Purgatory and Sink creeks have deeply incised vertical banks in isolated areas. The Texas Blackland Prairie topography within the watershed is much more subdued. It is comprised of gently undulating to nearly level bottomlands and terraces near the San Marcos River and nearly level to rolling uplands. This is due principally to the deep soils and high erodibility of the Pecan Gap Chalk and Pleistocene alluvial deposits as opposed to the generally very shallow soils and erosion resistant nature of the strata in the Edwards Plateau (an exception is the Del Rio Clay, which is highly erodible). Elevations range from 1,340 feet above mean sea level on the western divide near the

FIGURE 12

GENERALIZED PHYSICAL DIAGRAM
SAN MARCOS, TEXAS AREA

COMPILED BY A.D. HELLMAN FROM USGS NORTH SAN MARCOS QUADRANGLE 1:24000 (1964). DIAGRAM SCALE APPROX. 1:30000 (CENTER). VERTICAL EXAGGERATION 8:1 (ON ORIGINAL) 1970



headwaters of Purgatory Creek to 550 feet at the confluence of the San Marcos and Blanco rivers.

Soils

Soils in the watershed are grouped into three soil units. A soil unit is a unique natural landscape area that has a distinct pattern of soils, relief, and drainage features. A unit typically consists of one or more soils of major areal extent and some soils of minor extent. The three soil units named for the major soils are as follows:

Eckrant - Speck. This is the most extensive soil unit in the watershed comprising about 90 percent of the area. It includes all the Edwards Plateau Land Resource Area within the watershed. These soils are on gently undulating to steep landscapes with slopes ranging from 1 to 35 percent. The two major soils were developed over the Edwards Limestone formation. They are well drained, shallow, stony clays with moderately slow to slow permeability. Surface runoff is rapid (limestone bedrock crops out in much of the area, especially on the steeper slopes, effecting a high rate of surface runoff infiltration into the rock). Erosion hazard from wind and water is low. The allowable soil loss due to erosion is only about one ton per acre per year.

Heiden - Houston Black. This soil unit comprises six percent of the watershed drainage area. The soils in this unit are on the upland portion of the Blackland Prairie Land Resource Area. The nearly level to rolling landscape has slopes ranging from 1 to 12 percent. The soils are moderately well to well drained, deep, calcareous clays that are very slowly permeable. Surface runoff is slow to rapid depending on steepness of slope. The infiltration rate is rapid when the soil is dry and cracked but very slow when the soil is wet. Water erosion hazard is high on the steeper slopes. The allowable soil loss is about five tons per acre per year.

Oakalla - Tinn. This soil unit comprises four percent of the watershed drainage area. The soils in this unit occur on the flood plain of the San Marcos River and on adjacent terraces. The nearly level to gently sloping landscape has slopes ranging from less than one to about three percent. Most of the soils in this unit are deep, calcareous, and either clayey or loamy in texture. Surface runoff is generally slow to very slow. Erosion hazard is low to moderate depending on the slope. The allowable soil loss is about five tons per acre per year.

Climatic Features

Climatic conditions in the watershed and surrounding areas are warm and subhumid. Summers are hot and winters are generally mild but subject to

rapid and drastic temperature changes with passage of cold fronts. Temperatures range from a mean maximum of 36 degrees Celsius (96 degrees Fahrenheit) in July to a mean minimum of about 4 degrees Celsius (40 degrees Fahrenheit) in January. Annual mean temperature is about 19 degrees Celsius (67 degrees Fahrenheit). The normal growing season is from March 14 to November 23, or 254 days.

The average annual precipitation is 86.4 centimeters (34 inches), of which approximately 75 percent falls during the normal growing season. Winter precipitation is usually in the form of light rain or drizzle. March is usually the driest month of the year, while measurable precipitation is high during late spring. Summer is generally very dry and early fall relatively wet, followed by a significant decrease in precipitation during November.

Mineral Resources

Known mineral resources within the watershed are limited to stone, gravel, sand, clay, and caliche. Presently, there is one stone and gravel quarry operating intermittently in the eastern portion of the watershed. Two other quarries of significant size have been in operation in the past. On a very localized and limited basis, gravel, sand, and caliche have been removed from fault zones or from isolated lenses in the Edwards Limestone. Clay could be obtained from the Del Rio Clay formation, but its siltstone lens and gypsiferous nature limit its use.

Land Use

Land uses within the Watershed are shown in the following tabulation:

Land Use	Acres	Percent
Cropland	700	1.2
Pastureland and Hayland	1,480	2.4
Rangeland (including Native Pasture)	47,090	77.5
Urban and Built-up*	10,910	17.9
Small Water Areas	60	0.1
Other	540	0.9
Total	60,780	100.0

*Includes roads, railroads, unincorporated subdivisions, cemeteries, and educational institutions.

Present flood plain land uses are: cropland, 17 percent (includes 13 percent oats and 4 percent grain sorghum); pastureland and hayland, 4 percent; rangeland 28 percent (includes 5 percent native pasture) urban and built-up 50 percent; and miscellaneous uses such as county roads and state and Federal highways, 1 percent.

Surface Water Resources

The San Marcos River is a natural stream with perennial flow. Base flow of the river originates from San Marcos Springs. All tributaries to the San Marcos River above the Blanco River have ephemeral flow conditions and have unmodified, well defined channels. However, a few very small springs or seeps on the tributaries discharge a minor amount of streamflow during and immediately after periods of abnormally high rainfall. The San Marcos River channel (about five miles) is in its natural state except for about 600 feet in Sewell Park in San Marcos where the river has been confined by concrete banks on both sides. There are two low water retention structures, one is Rogers Dam which forms a back water effect and one is an unnamed structure which impounds Spring Lake.

Surface water resources for livestock and wildlife uses in the area are from small farm ponds and limited ground-water seeps. The quality of water from those sources is considered to be within tolerable limits for health and safety for the locale. However, during prolonged periods of drought, they are not reliable sources of water.

At the present time, large amounts of supportive data exists for surface water quality and quantity of the San Marcos River (U.S. Geological Survey, Texas Department of Water Resources, Texas Parks and Wildlife Department, Texas State Department of Health, Guadalupe-Blanco River Authority, Southwest Texas State University, and Espy-Huston and Associates). The river with its cool, crystal-clear waters has become nationally famous. Its unique aquatic habitat and recreational attributes makes the upper reaches of the San Marcos River one of the most valuable water resources in Texas (Espy-Huston and Associates, 1975). Because of perennial flow conditions from the Edwards Aquifer, the temperature of the upper reaches of the river varies little from a 20 degrees Celsius (74 degrees Fahrenheit) average (Texas Water Quality Board, 1976). Turbidity (except during periods of storm runoff) is usually less than 2 Jackson Turbidity Units.

Wetlands

There are no recognized wetlands in the watershed.

Present and Projected Population

Census data limited to the watershed is not available. San Marcos with a 1973 estimated population of 20,030 is located in the southeastern portion of the watershed. It is estimated that the population will more than double to 43,100 by the year 2000 (Texas Water Development Board, 1972). San Marcos has benefited from its excellent highway access to Austin and San Antonio. Interstate 35 makes commuting possible to either of those metropolitan areas. Much of the growth must be attributed to the rapid growth of Southwest Texas State University, whose enrollment has increased from 4,461 students in the fall of 1964 to 13,561 in the fall of 1976.

Racially and ethnically, the population composition of San Marcos and Hays County has not changed materially during the last twenty years. Hays County has an estimated 1973 population of 33,700 of which approximately 58 percent Anglo, 38 percent Spanish surnames, and 4 percent Negro. Statewide, the distribution is 69 percent Anglo, 18 percent Spanish surname, and 13 percent Negro.

Economic Resources

There are approximately 100 farm and ranch units wholly or partially within the watershed. These units average about 500 acres in size and range from less than 10 to more than 6,200 acres. There has been a gradual increase in size and a decrease in the number of farms. About 95 percent of the agricultural land is owner-operated. There are 17 farm and ranch units that have land within the flood plain.

Historically, Hays County has largely been dependent upon agriculture, with San Marcos serving as a market center. Most of the cultivated acreage lies to the east of Balcones Escarpment where cotton, sorghum, maize, hay, and other field crops predominate. In the hill country west of the escarpment, ranching is the prevailing land use. San Marcos has developed an industrial park and is actively seeking selected industries for location there. Thus, the manufacturing sector will in all likelihood retain its importance in the future.

Agriculture was the leading employer in the county until 1967, when Federal employment took the lead with the opening of the Gary Job Corps facility. Recently, cutbacks at this center have enabled Southwest Texas State University to become the foremost employer. Agriculture, the only category to show a consistent decline, is still important, but no longer among the leaders. The University, Federal government, elementary and secondary schools, retail trade, and manufacturers now exceed agriculture as employers.

The rapid increase in university enrollment has greatly influenced other economic sectors such as construction, retail, personal services, amusement, lodging, etc. Thus, the economy of the city in particular and the county in general, directly or indirectly, relies very heavily upon the university. In addition, numerous tourist facilities attract thousands of visitors each year. San Marcos is often referred to as a university and tourist city.

Land in the Edwards Plateau with its low productivity and carrying capacity sells at higher unit prices than the more productive Blackland Prairie to the east. With few exceptions, prices for the Edwards Plateau range between $1,000 and $2,000 per acre. Land values depend upon the acreage involved, accessibility, and aesthetics such as view and tree cover.

Approximately 102 miles of Federal, state, and county roads, of which all are hard-surfaced, serve the watershed residents. The Missouri Pacific and Missouri-Kansas-Texas Railroads have loading and unloading facilities at San Marcos. Amtrak's Inter-American provides rail passenger service.

Based on 1969 Agricultural Census data for Hays County about 53 percent of the farms and ranches gross less than $2,500 annually from agricultural sales. Approximately 52 percent of the farm and ranch operators worked off-the-farm 100 days or more in 1969. It is estimated that less than five percent of the agricultural land in the flood plain area is in operating units using one and one-half man-years or more of hired labor.

The "Labor Force Estimates for Texas Counties, October 1976," shows a labor force of about 15,570 for Hays County. Slightly over seven percent, or about 1,100 workers are unemployed. This is above the State rate of unemployment.

Hays County is within the geographic area served by the Capitol Area Planning Council.

Plant and Animal Resources

Floral Setting

Gould (1962) has divided Texas into ten primary vegetational areas. The Upper San Marcos River Watershed is somewhat unique in that it occurs within portions of two vegetational areas: Blackland Prairies and Edwards Plateau (Figure 12). Mixing of the two areas increases the botanical diversity. The Edwards Plateau Vegetational Area is bounded on the east and south by the Balcones Escarpment. Within the watershed, the climax vegetation for that area of the Edwards Plateau is a tall or mid-grass rangeland, mixed with brush or open savannah. The climax vegetation of the Blackland Prairie is a tall grassland.

Present Plant Communities

Terrestrial. The major plant communities (if freely interpreted from present land uses and excluding areas of towns, roads, etc.) are native savannah, improved pasture, seeded areas, and field crops. The native savannah and its associated grasslands and wooded areas is used as rangeland.

Within the watershed, the plant community for the Edwards Plateau is predominantly an oak-juniper association. Dense growths of oaks commonly occur on limestone outcrops, juniper on marly slopes, and elm and hackberry interspersed with oaks are common along stream bottoms. Mesquite occurs in some areas and is commonly associated with pricklypear cactus and agarito. Grasses are the dominant understory plant community. The important grasses are switchgrass, bluestems, gramas, indiangrass,

wildrye, curly mesquite, and buffalograss. The rough, rocky areas typically support a tall or mid-grass understory and a brush overstory complex made up of live oak, shinnery oak, juniper, and mesquite. The Edwards Plateau is predominantely rangeland and is stocked with combinations of cattle, sheep, and goats.

Most of the Blackland Prairie has been placed in cultivation or improved pasture and very little rangeland exists. In some areas, the tall climax grasses have been replaced by texas grama, texas wintergrass, buffalograss, smutgrass, and many annuals. A more detailed listing of climax plants on rangeland is provided from the Range Site Descriptions maintained in the respective local SCS field offices.

The most common tree along the San Marcos River is pecan with associations of cedar elm, hackberry, and bald cypress. Plants commonly encountered in surveys of the area near the San Marcos River are: bedstraw, southern dewberry, and rescue grass away from the banks; box elder, pecan, hackberry, wild onion, red seeded plantain, scouring rush, yaupon, and elephant ear near the water's edge; and brushy honeysuckle, poison ivy, bull briar, and bur clover on the slopes near the river.

Hydrologic cover conditions on the watershed are concerned with the quantity of existing vegetation and litter and its effect on runoff rather than species composition. An estimated 54 percent of the rangeland is in good hydrologic condition, 44 percent is in fair hydrologic condition, and 2 percent is in poor hydrologic condition. Approximately 86 percent of the cropland is in good hydrologic condition and the remaining 14 percent is in poor condition. All of the pastureland is in good hydrologic condition.

Aquatic. The major aquatic plants of the Upper San Marcos River Watershed are located in the Spring Lake-San Marcos River.

The Upper San Marcos River is divided into three distinct segments according to plant species population and diversity: Segment 1, Spring Lake to Thompson's Island; Segment 2, Thompson's Island to the San Marcos Sewage Treatment Plant; and Segment 3, San Marcos Sewage Treatment Plant to the confluence of the San Marcos and Blanco Rivers (Figure 13).

Segment 1 is dominanted by patches of arrow head, seedbox, pondweed, fanwort, eelgrass, and Texas wildrice. Elephant ears are abundant along banks. Segment 2 has a greatly reduced diversity compared to Segment 1. Strictly aquatic plants found in this segment are mostly patches of Texas wildrice and Heteranthera. Segment 3 is void of submersed aquatic plants. Elephant ears and water hyacinth are found along the banks and in the littoral zones throughout the segment.

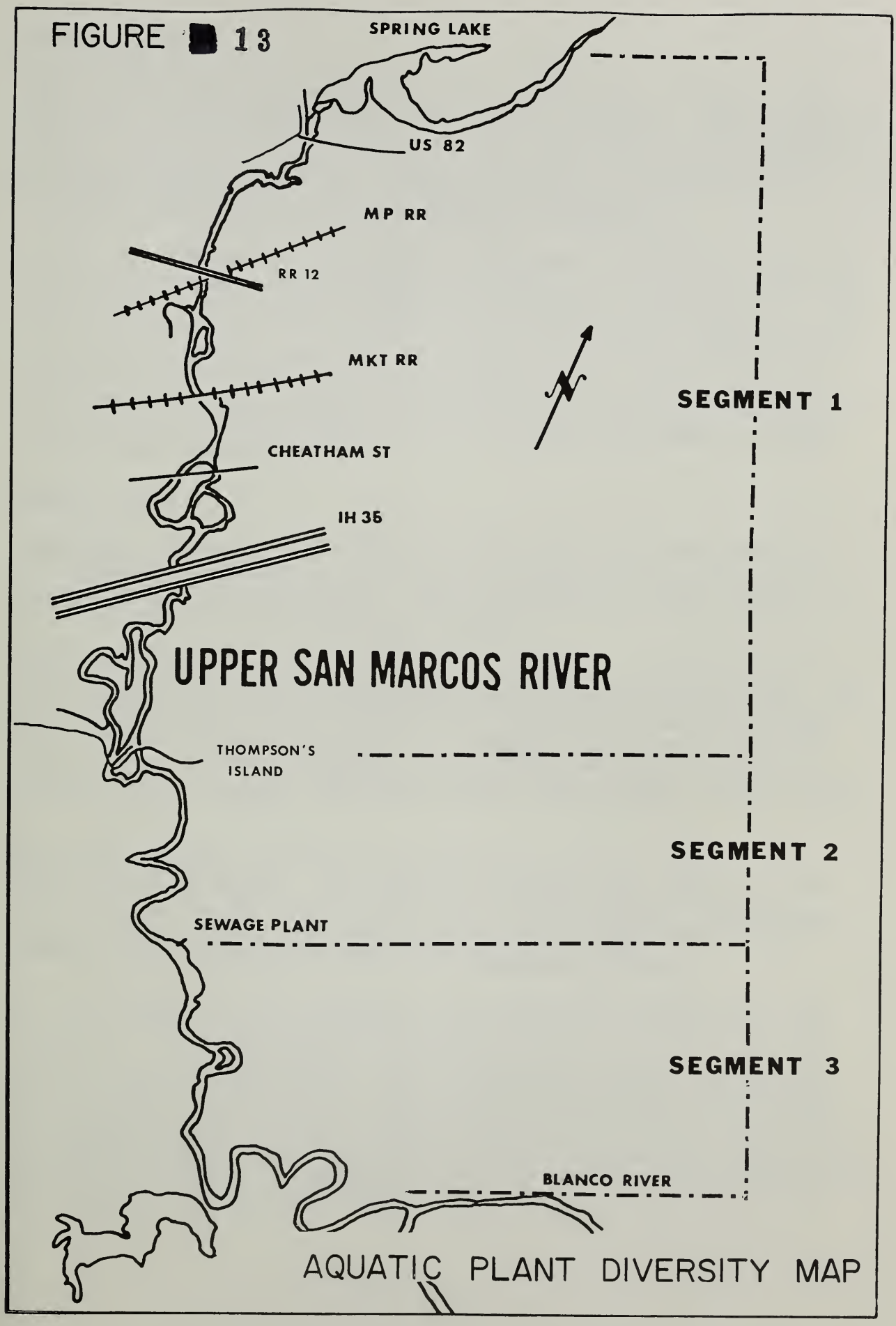


FIGURE 13
SPRING LAKE
US 82
MP RR
RR 12
MKT RR
CHEATHAM ST
IH 35
UPPER SAN MARCOS RIVER
THOMPSON'S ISLAND
SEGMENT 1
SEGMENT 2
SEWAGE PLANT
SEGMENT 3
BLANCO RIVER
AQUATIC PLANT DIVERSITY MAP

Faunal Setting

Blair (1950) places the geographic area of the Upper San Marcos River Watershed in the Balconian and Texan Biotic Provinces. These correspond to Gould's (1962) Edwards Plateau and the Blackland Prairie Vegetational Areas. The division between the two areas runs along the Balcones Escarpment (Figure 12). All floodwater retarding structures are located in the Balconian Biotic Province above the escarpment.

For practical purposes, the structure locations are sited on one wildlife habitat type, an oak-juniper association. Two characteristic sub-associations exist within the dominant oak-juniper association; an open area sub-association and a woody area sub-association. Certain plants are associated with open areas and others are associated with woody areas, but are not found in both sub-associations. Other plant species occur throughout the watershed and are found in both sub-associations. The primary use made of vegetation is as forage and browse for sheep, goats, cattle and wildlife.

Aquatic Fauna

Amphibian. The San Marcos salamander (not the Texas blind salamander) is especially significant since it only occurs in Spring Lake, headwaters of the San Marcos River. This salamander is totally aquatic and has a low tolerance for temperature changes.

Fish. One class, 7 orders, 12 families, 29 genera, and 52 species of fish have been reported from the Upper San Marcos River Watershed. The major fishes that occur in the Upper San Marcos River are largemouth bass, channel catfish, *Gambusia* spp., *Notropis* spp., and various sunfishes. Some of the more exotic species introduced by man are the Mexican tetra, rockbass, Rio Grande perch, Amazon molly, sailfin molly, and tilapia.

Macroinvertebrates. Several invertebrate species are unique to the Upper San Marcos River. Four species of caddis flies endemic to the spring run of the Upper San Marcos River are *Protoptila* (=*Glossosoma*) *arca*, *Protopila parce*, *Cheumatopsyche* (*Sordida*) *comis* (Edwards and Arnold, 1961, and Edwards, 1973), and *Metrichia nigretta*.

A large freshwater prawn (shrimp) is an interesting inhabitant of the San Marcos River and specimens reaching 14 inches in length have been captured. Little is known of its life history, although it is thought that the adults return to the coast to breed in estaurine waters since females taken in the river are never gravid. At one time these prawns were distributed far inland in several major rivers in Texas, but today the San Marcos River is one of the few rivers in which this species is found as far inland. It is reported that 70 years ago these prawns were commercially harvested from the San Marcos River.

Nektonic collections indicate the San Marcos River above the sewage treatment plant is in excellent condition. Below the sewage treatment plant, faunal diversity is typical of a stream approaching moderate pollution.

Ground-Water Fauna

Invertebrates that occur in ground waters of the San Marcos region comprise a unique fauna with many endemic species. These included the first aquatic cave beetle ever reported from North America, four undescribed species of amphipod, and large numbers of asellid.

Terrestrial Fauna

Reptiles and Amphibians. Following rains, Gulf Coast toads commonly appear on roads and lawns. Texas cliff frogs are common on the rugged hills along the escarpment. The reptiles most often seen are the greater earless lizard in rocky areas, and the Texas spiny lizard in trees. In leaf litter around trees, particularly where moisture is present, the ground skink is very common. The six-lined racerunner and green anole are commonly observed. Common snakes are racers, rough green snake, western diamondback rattlesnakes, coral snake, checkered garter snake, and *Natrix* spp.

Birds. The Rio Grande Turkey is the bird most likely to be affected by the proposed construction. This turkey is noted for use of long established winter concentration roosting areas. Such areas become traditional by nature and when destroyed, they are not easily reestablished. During field investigations, turkeys were observed or heard in the vicinity of proposed Structure Nos. 1, 2, and 3. The largest group, eight or nine birds, was observed just downstream from proposed Structure No. 2. In addition, roosting activity was confirmed in a large elm tree in the area to be dedicated to the sediment pool of Structure No. 2.

Other game birds are the bobwhite quail and the mourning dove. Quail receive very little hunting pressure in this area. The habitat at the proposed structures offers good cover and considerable food for quail. Although no estimate of numbers could be made, moderate sized coveys were observed. Mourning dove do not receive much hunting pressure though they are numerous at all structure locations. Dove hunting on the Edwards Plateau is primarily limited either to fields with grain crops or to sources of water.

Non-game birds are abundant in the watershed, a region that throughout the year attracts a great diversity of species. There are 294 species representing 50 families of birds that are known from this area. One species that deserves special attention is the golden-cheeked warbler. From early March through early July, this warbler inhabits the wooded slopes and canyons in Central Texas and areas to the north typically covered with mature ashe juniper. Although marginal habitat exists in

the watershed, no significant habitat is found in the areas proposed for construction of the structures.

Mammals. Whitetail deer are important to the economy of the Edwards Plateau region. Landowners commonly lease their land for deer hunting. Deer populations in this area, as determined by Texas Parks and Wildlife personnel, are as follows:

Deer Population Densities for Hays County 1/

YEAR	DEER/100 ACRES	ACRES/DEER	BUCK/DOES
1971	20.28	4.93	1:2.1
1972	16.31	6.13	1:3.11
1973	19.19	5.21	1:3.41

1/ Approximately equivalent to the Upper San Marcos River Watershed

Number of furbearing animals harvested in the watershed are not available; however, one fur buyer living within the watershed area paid over $30,000 for 4,077 furs during the trapping season in 1977-78. Raccoons are the primary furbearer harvested. Opossums are the second most harvested furbearer. Other common furbearers in the area include ringtail, coyote, gray fox, nutria, skunk, and bobcat. Hunting of furbearers by either trapping or headlighting has become a very popular sport in this area over the past few years.

Endangered and Threatened Species

Flora. The Fish and Wildlife Service, USDI (1978) has prepared an official Federal inventory that gives the status of endangered or threatened flora. Texas wildrice is the only listed species with distribution in the project area. The total natural range of this species occurs within the watershed area (Longley, 1975). Texas wildrice is the only perennial rice known and its distribution is limited to approximately 1,000 square meters in the cool, fast flowing upper reaches of the San Marcos River.

Fauna. The Fish and Wildlife Service, USDI (1974) recognizes four species of endangered animals whose natural ranges extend into the project area. Two of the four species are birds--southern bald eagle and American peregrine falcon. Habitat is not preferable for inducing or sustaining a population of these birds; and is only transitory, offering neither preferred nesting sites nor a sustained food source. Neither of the birds were observed during investigations.

The other two species are the Texas blind salamander and the fountain darter. The Texas blind salamander is known only from the San Marcos pool of the Edwards Aquifer. This unusual subterranean species is observed only when it makes its way to the surface through well openings and cracks in the porous limestone (Longley, 1977). The fountain darter, a small river fish, occurs in the upper reaches of the San Marcos River (Schenck, 1975, and Young, 1973). The aquatic habitat of both of these species is not in jeopardy; however, polluting the aquifer from man-made sources or pumping to dangerously low levels could affect both species. Maintaining aquatic habitat in the San Marcos River is critical if adequate breeding populations of the fountain darter are to be sustained.

Texas Parks and Wildlife Code (Chapter 68, Acts of the 64th Legislature, Regular Session, 1975) provides additional protection to the above endangered species and another fish, the San Marcos gambusia. Similar protection has been afforded the San Marcos salamander and the golden-cheeked warbler under Chapter 67 which relates to protected nongame. In addition, the San Marcos salamander has been proposed for endangered status.

No other endangered or threatened vetebrates or invertebrates were found to have range distributions within the watershed, and no additional sightings or evidence have been recorded of any other species.

Recreational Resources

The San Marcos River is the major water source for public water-based recreational use (Texas A&M University, 1975). There are several public park areas in the watershed. The City maintains about 170 acres at several locations. Parkland along the river provides about 7,730 recreational days annually. Good fishing is available along the San Marcos River. On an invitational basis, some fishing is permitted on farm ponds scattered throughout the watershed.

The route along Farm Road 2439 south of San Marcos and Ranch Road 12, between San Marcos and Wimberly, has been designated as a part of the Texas Hill Country Trail, a recreational program of the Texas Department of Highways and Public Transportation. Approximately 14 miles of those roads cross the watershed.

Historical and Archeological Resources

There are two historic landmarks recognized by the U.S. Department of the Interior, National Park Service (1973 and subsequent dates) in the watershed (Hays County). The first landmark, known as the Cock House, is located at the corner of Hopkins Street and C.M. Allen Parkway in San Marcos; and the second landmark is the First United Methodist Church located at 129 W. Hutchison Street. The Texas Historical Commission (1975) lists more than 30 state historical markers in San Marcos and vicinity. Ezell's Cave on the campus of San Marcos Baptist Academy has been designated as a Natural Landmark by the National Park Service.

Archeologists, with the Texas Archeological Survey, The University of Texas at Austin, conducted an initial archeology survey (Patterson 1974). 1/ A total of 17 artifact sites were located within potential areas of construction or inundation by Floodwater Retarding Structure Nos. 1, 2, and 3. Additional archeological surveys were conducted by Scott and Prewitt (1976) to assess the eligibility of three sites for nomination to the National Register of Historic Places. 1/

SCS archeologists completed a survey of areas that might be affected by installation of a water resource improvement and recreational facilities along the San Marcos River. 1/ Four (4) archeological sites were found, two of which are considered eligible for nomination to the National Register of Historic Places. The location of the water resource improvement and the recreational facilities will not effect any of the sites; therefore, no further work is anticipated.

Soil, Water, and Plant Management Status

The Comal-Hays-Guadalupe Soil and Water Conservation District (SWCD) has responsibility for the conservation of soil, water, plant, wildlife, and related resources. Land users cooperating with the SWCD in the application of a conservation program are provided technical assistance by the SCS through an existing memorandum of understanding with the United States Department of Agriculture.

About 100 farm and ranch units within the watershed are under agreement with the SWCD. Ninety-five of those land users have developed conservation plans covering about 49,230 acres or about 99 percent of the agricultural land in the watershed. Approximately 33,640 acres or 68 percent of the agricultural land is adequately treated. SCS field offices at New Braunfels and San Marcos are assisting the SWCD in preparing and applying conservation plans. Soil surveys which are essential to conservation planning have been completed.

Land use changes are occurring in the watershed. Rangeland located in the Edwards Plateau Land Resource Area and cropland located in the Blacklands Land Resource Area are being converted to urban and built-up lands. This trend is expected to continue.

Projects of Other Agencies

There are no existing or proposed water resource development projects of other agencies within the watershed. The works of improvement included in this plan will have no known detrimental effects on any existing or proposed downstream works of improvement, and will constitute a harmonious element in the full development of the Guadalupe River Basin.

1/ Those findings are available for review at the State Office, Soil Conservation Service, W. R. Poage Federal Building, Temple, Texas 76501.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land and Water Management

Land users have made significant progress in the application of conservation measures. However, there is a constant need to apply and maintain land treatment that reduces erosion. There is every indication that cooperators will continue to do so under the going program (Public Law 46).

The major problem on cropland is sheet erosion. There is a definite need for farm operators to continue to apply conservation cropping system, contour farming, and crop residue management to reduce erosion and conserve moisture.

Low fertility, invasion of brush, and poor management are the main problems on pastureland. There are isolated areas in the watershed of abandoned or idle cropland that show evidence of erosion. Most of these areas are being seeded to adapted pasture or native range plants and are being maintained.

Inadequate forage production resulting from overgrazing is the primary problem on rangeland. About 1,800 acres of rangeland are so heavily infested with woody plants that forage production is reduced and returns from livestock grazing are significantly lowered. These woody species need to be managed to meet the management goals of the operator or landowner. The seeding of adapted high quality native plants may be necessary.

Additional watering facilities for livestock are needed on ranches. Large pastures need additional cross-fencing to allow proper grazing use and deferred grazing for better grassland management. Approximately 1,500 acres of rangeland need additional treatment for optimum production and protection from erosion.

Floodwater Damage

San Marcos has a long history of catastrophic floods. Major floods have occurred in 1921, 1929, 1970, 1972, and 1974. The most disasterous flood in recent years occurred on May 15, 1970. The total storm rainfall, over a 24-hour period, varied from six inches in the upper portion of the watershed to the 13 inches recorded at San Marcos. The resulting flood was estimated to have a recurrence interval of 84 years. Approximately 1,850 acres of flood plain were inundated; about half was urban area. Two children drowned. If the flood had occurred during the night, the loss of life could have been greatly multiplied. The depth of flood water, which occurred at one apartment complex was 11.6 feet above the first floor elevation. Access to portions of San Marcos was impossible due to the closing of many roads. Damage to homes and personal property was so severe that familes were dislocated for weeks.

With present conditions approximately 890 residential properties, 80 commercial establishments, and 20 public buildings would receive floodwater damage by a flood equivilent to the 1970 event. The direct monetary damage is estimated to be $7,717,760, of which $7,690,980 is in the urban area.

Flooding on Purgatory Creek occasionally interrupts traffic flow on Hunter Road, however, alternate routes are available. Traffic is frequently halted on Lime Kiln Road by high water from Sink Creek. This represents a far more critical situation because no alternate means of access is available. Several subdivisions and numerous farms and ranches are completely isolated when flood conditions prevail. This is not only a nuisance, but is a safety hazard and danger to health in the event of an emergency. Several city streets in San Marcos are also closed by small floods.

Evaluation reaches are presented on the Project Map (Appendix D). Major floods, inundating more than half the flood plain, occur in Evaluation Reach 1, below the urban area of San Marcos, average of once every five to ten years. Major flooding occurs in Evaluation Reach 2, which is entirely within the urban area, on the average of once every two to five years. Evaluation Reaches 3 and 4 are Sink Creek and Purgatory Creek, respectively, which flow into the urban area of San Marcos. Major floods occur in Evaluation Reach 3 on the average of once every one to two years. Reach 4 has major floods occurring once every two to five years. Minor floods, inundating less than half the flood plain, occur on the average of about four to five times a year. Cumulative totals of recurrent flooding show an average of 1,535 acres flooded annually during the evaluation period.

An estimated 1,887 acres of the watershed, excluding stream channels, are flood plain which would be inundated by a 100-year frequency flood. About 951 acres of flood plain are classified as urban land and 936 acres are classified as agricultural land (Figure 1). There are 17 farm and ranch units that have flood plain land. In the urban portion, approximately 908 residential properties, 92 commercial establishments, and 23 public buildings are subject to flood damage in the urban portion. The direct monetary damage resulting from such a flood is estimated to be $8,259,300, of which $8,231,600 is in the urban area.

Erosion Damage

Water erosion occurs principally as sheet, rill, and gully erosion. The estimated annual gross erosion rate for the entire watershed is 1.07 tons per acre. Sheet erosion accounts for 94 percent of this rate, and streambank and gully erosion the remaining 5 and 1 percent, respectively. It is anticipated that future with project conditions, the weighted annual erosion rate for the watershed will be 1.02 tons per acre. The future percentage distributions among the three types of erosion will be essentially the same as for present conditions.

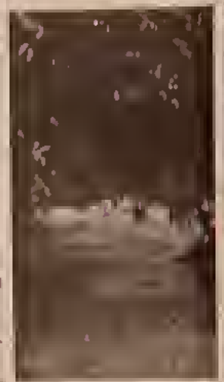
Rushed Down Purgatory and Sink Springs


STREETS BECAME RIVERS, each leading to destruction in the San Marcos River.


LOOKING DOWN HOPKINS toward the river at height of the flood.


A PAIR OF BOOTS stands on the edge of flood waters, mute evidence that someone waded in to help.


TRYING TO MOVE on Loop 82, these rain walkers had more luck than vehicles Friday morning.


STANDING ON A CAR, these young men are surrounded by the flood.


THIS SCHOOL BUS luckily held no children as it was almost entirely engulfed by flood waters on South LBJ at Purgatory Creek.


AUTOS BURIED along the frontage of Clear Springs Apartments during the height of the flood.


FURNITURE lodged in this railing of Clear Springs Apartments as flood waters ripped into the lower floor.


SAN MARCOS looked like this about 4 p.m. Friday. Hopkins Lane held waters to form a large lake including the new public housing project while the flat areas including Little League parks also held water.

Waters Receded to Show a Sodden Mess


FLOODS MESS THINGS UP, as can be seen in this photo on the railroad bridge just above Rio Vista, yet the sun came out bright Saturday and San Marcos has already made great strides in cleaning up.


SHORTLY AFTER the flood subsided, Travis Elementary looked like this.


THIS RAILROAD TRESTLE stopped several drifting autos in the vicinity of Travis Elementary Friday morning. At least one contained a man and his children who climbed to safety on the railroad track from the rushing waters.


ALREADY RECEDING, the San Marcos River begins to reveal its toll in the center of Sewell Park.


WATERS CONTINUE TO BOIL past Clear Springs Apartments even during the afternoon Friday. A few hours earlier the waters had been even higher to gush into the lower stories of the apartments.


BRAND NEW PUBLIC HOUSING just off Bugg Lane and Thorpe Lane received considerable damage from flood waters. People had just moved into the buildings [illegible]

... A Time of Despair


THIS COLD STORAGE building floated from behind Day's Riverside Grocery.


(Photo by [illegible])

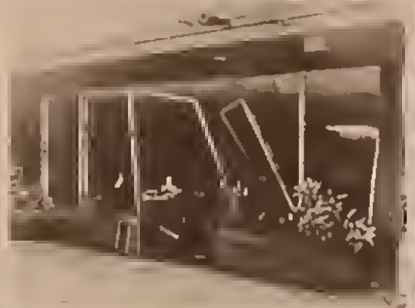
CATCHING AN ALLIGATOR, these Aquarena men keep at a safe distance. Most of the escaped gators have been recaptured, but other animals, such as the goats in the foreground, perished in the flood.


RIVERSIDE DRIVE HOMES—and those on other streets near the rivers and creeks—looked like this when the flood receded. Water in this home of the Johnny Hendersons reached almost to the ceiling level.


FORD ON A SEESAW teeters in City Park.


SEWELL PARK looked like this with the river back to normal.


[illegible] show the damage from the flood, but quick work had [illegible] moving [illegible] hours after the flood had subsided.


AQUARENA SUFFERED heavily from the waters that rushed down Sink Springs Creek.


CARS LOOKED LIKE THIS after being under the swirling waters.

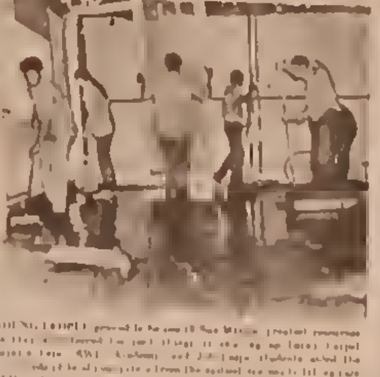

STACKED LIKE TENPINS are these cars behind Clear Springs Apartments. Workers had already begun to unsnarl the mess by mid-afternoon Friday.


A NEW ENTRANCE to Evans Field was opened by water power as it ripped down this rock wall on the southern end of the stadium.

Now the People of San Marcos Clean Up


[illegible]


[illegible]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MARCOS
RECORD

While soil erosion in the watershed is not a general problem, some localized areas need erosion control. Sheet erosion is occurring on some grain sorghum cropland at annual rates exceeding 20 tons per acre. This is over four times the allowable soil loss for most of the soils in those areas. Likewise, small isolated grassland areas are experiencing sheet erosion at rates far beyond the allowable soil loss. Excessive annual erosion rates of two to 10 tons per acre have been estimated for some rangeland areas. The annual allowable soil loss for most of these rangeland areas' is one ton per acre.

The average annual erosion rate within the urban area of San Marcos is estimated to be 0.06 tons per acre which is not excessive. There are areas underlain by the Del Rio Clay within San Marcos and other areas in the watershed where the potential for mass movement or slumping of the clay-shale bed rock exists (Figure 3). It is particularly important that slopes created in this formation by excavation during construction of streets, residences, public buildings, etc. be near enough to the horizontal to prevent this problem.

Flood plain scour (sheet erosion) and valley trenching (gully erosion) are negligible on an average annual basis. Detailed investigations and monetary evaluations of this damage were not made. Streambank erosion, though relatively minor, is presently contributing an average of 3,488 tons of sediment annually. A decrease is anticipated because of land treatment under the going program to 3,157 tons under future-without-project conditions.

Most streambank erosion is occurring in the Edwards Plateau portion of the watershed and consists mostly of the reworking of boulder size limestone to small gravel by runoff from high intensity, short duration, low frequency storms.

Sediment Damage

Present sediment damage within the watershed is minor. The limited amount of deposition, configuration of the flood plain, soil types, and land use are factors limiting damages to the productive capability of the flood plain. Detailed flood plain investigations and monetary evaluations were not made because of the minimal damages.

Sedimentation can be a problem from an esthetic viewpoint. Since 1971, sediment has accumulated immediately upstream from the Loop 82 bridge at the confluence of a small unnamed tributary and the San Marcos River. This deposition, consisting mostly of clay and silt, accumulated in a relatively short time as a result of urban construction. The sediment is presently supporting the growth of weeds and black willow.

It is estimated that 20,900 tons of sediment are presently yielded annually to the outlet of the watershed. In terms of average annual suspended sediment yield, this amounts to 120 milligrams per liter.

Land treatment under the going program will reduce suspended concentrations to 110 milligrams per liter. Monetary damages were not estimated for these concentrations.

Indirect Damages

Indirect damages such as interruption or delay of travel, rerouting school buses and mail routes, losses sustained by business and farming operations, evacuation cost (including the threat of floods), and similar losses are estimated to average $113,850 annually.

Municipal and Industrial Water Problems

Municipal and industrial water is obtained from wells in the Edwards Underground Reservoir. The aquifer presently furnishes an abundant quantity of high quality water for these purposes.

San Marcos' location on Interstate Highway 35 connecting the Austin and San Antonio metropolitan areas is conducive to population growth and industrial expansion. Using population growth projections as a basis, it is evident future water demands on the Edwards Underground Reservoir will greatly increase. The average daily water use for San Marcos during 1973 was 2,059,290 gallons. Assuming the per capita usage remains constant, the average daily demand will increase to 4,430,680 and 7,267,960 gallons per day for the years 2000 and 2020, respectively.

Computer model studies of the Edwards Underground Reservoir show that the San Marcos Springs could possibly cease to flow by the year 2009 (Klempt et al. 1975). San Marcos and surrounding water users rely on wells rather than spring flow for source of water. Thus, while the ceasing of spring flow would not cut off the source of water for these users, it would affect the quantity of water available at a time when demands increase.

The Edwards Underground Reservoir has a notable ability for rapid recharge. Consequently, it is highly susceptible to contamination. Urban and industrial expansion on the recharge zone could result in increased potential for pollution of the aquifer and the water it contains. Extreme caution and careful management will be necessary in the recharge zone to maintain the high quality water in the aquifer. It is also imperative, due to anticipated population and industrial growth, that every reasonable means be implemented to sustain and augment ground water supplies.

Recreation Problems

There is a definite need for additional facilities to better accomodate the tremendous usage of the San Marcos River and to better serve the needs of the residents of San Marcos as well as the region. According to the Regional Outdoor Recreation Plan, 1973-1990, Capital Area Planning

Council, there is a deficit of approximately 200 acres of parkland, 100 picnic tables, and 33 miles of hiking trails. These figures are based on an approximate population of 37,000. The population figure includes Southwest Texas State University and Gary Job Corps. The estimated population within a 10 mile radius of San Marcos is 39,000 and the population within a 25 mile radius is approximately 107,000 (Figure 10). Development of recreational facilities will be a positive step toward reducing the deficit of various facilities in this region.

The present overuse of the park and lack of sufficient facilities have led to a deterioration of the vegetative ground cover and a potential erosion problem. Additional roads and parking, and controlled circulation of both pedestrian and automobile traffic are needed. Some areas need to be shaped, filled, and re-vegetated. Also, additional picnicking facilities are needed to disperse picnickers over a larger area eliminating concentration.

Several streets and railroads crisscross the area making travel by foot hazardous and are not contributing to the recreational experience. There is a need to develop pathways where users can walk from area to area in relative safety from automobiles and trains.

Plant and Animal Problems

The continued conversion of rangeland and cropland to urban uses has removed needed wildlife habitat. Some wildlife, such as deer and squirrels are able to live in close proximity to man as long as forage and limited cover exist. However, the native habitat needed for a large deer herd is being depleted in the Upper San Marcos River Watershed. Other species, such as turkey, are not able to tolerate human encroachment. These species will often move out of an area rather than come in contact with man. Much of the suitable nesting cover for turkeys has been overgrazed.

Brush management practices applied in the past without regard to wildlife needs have reduced the quality of wildlife habitat. Whitetail deer in the watershed are generally in poor condition due to over population. There is a lack of quality food to sustain the present deer numbers in good condition. Generally, cropland in the Blackland Prairie lacks variety of food and cover to sustain good wildlife populations.

The San Marcos River has a unique ecosystem. The concern is how much effect man will have on the river and its endangered and unique species. All development must be well planned and all environmental effects considered. The influence of man has caused some major changes. It has been common practice over the past 20 to 30 years to introduce exotic species. Many of these have become a nuisance; others have severely competed with the native species.

The quality and amount of fish habitat is limited in the Edwards Plateau because of inadequate pond size and depth and unsuitable pond sites.

Pollution or depletion of the Edwards Aquifer will adversely affect ground-water fauna.

Water Quality Problems

The major problem associated with water quality in the upper reaches of the San Marcos River is sediment and bedload material delivered from uncontrolled areas of construction. The major sources of this material have been from construction sites for new roads, homes, apartments, offices, and classroom facilities.

Economic and Social Problems

Additional employment opportunities are needed for the 1,100 unemployed workers in the county. The population of Hays County increased from 19,334 persons in 1960 to 33,700 persons in 1973 (estimate) an increase of about 74 percent. During the same period of time, San Marcos has increased from 12,713 to 22,030, an increase of about 73 percent. Further increase in population could be anticipated with a concentrated effort in community development and additional employment opportunities.

RELATIONSHIP TO LAND USE, POLICIES, AND CONTROLS

The City is currently enforcing a zoning ordinance which regulates new construction and home and business improvements in areas subject to flooding.

The Texas Department of Water Resources has permitting authority to control potential pollutant sources from entering the Edwards Underground Reservoir.

ENVIRONMENTAL IMPACT

Flood Plain Regulation

Installation of the project will require the City to continue enforcing an existing flood plain zoning ordinance for the life of the project. Upon completion of the planned project, the minimum ground floor building elevation will be reduced to the 100-year with project flood elevation (Figure 1). Enforcement of flood plain zoning will not cause a change in basic land use. The urban area will remain urban. It will, however, require all watershed residents to consider the safety and building precautions to be taken in future development of flood plain lands and ultimately prevent increased flood damage.

Structural Measures

Flood Prevention

The installation of the planned structural measures will achieve the project objectives of flood damage reduction. The project will reduce flood damage on 1,887 acres and will benefit directly the landowners in the flood plain. In addition, damage to railroads, streets, utilities, and automobiles will be reduced.

Acres inundated in each evaluation reach without and with the project by various frequency floods are presented in the following tabulation:

Area Inundated by Selected Recurrence Intervals

Evaluation Reach 1/	Recurrence Interval: 2-Year Without Project (acres)	2-Year With Project (acres)	5-Year Without Project (acres)	5-Year With Project (acres)	20-Year Without Project (acres)	20-Year With Project (acres)	100-Year Without Project (acres)	100-Year With Project (acres)
1	45	4	68	9	106	40	139	61
2	232	0	417	0	722	18	951	136
3	217	22	261	93	358	196	403	213
4	130	69	228	94	311	175	394	260
Total	624	95	974	196	1,497	429	1,887	670

1/ Project Map (Appendix D)

The proposed project will prevent flooding above the first floor elevation from the 100-year frequency event to all existing urban properties except a tourist-recreation development and an apartment complex. The 100-year frequency flood with project conditions, is a maximum of 4.3 feet deep in one section of the apartment complex and 0.8 foot deep in the tourist-recreation complex. These depths are measured above floor elevations. If the project had been installed at the time of the May 1970 flood, acres flooded would have been reduced from about 1,850 acres to about 660 acres, a reduction of approximately 64 percent. The maximum depth of floodwater in a building (apartment complex) would have been reduced from 11.6 feet to 4.1 feet.

The number of urban properties inundated without and with the project by various frequency floods is presented in the following tabulation:

Urban Properties Inundated by Selected Recurrence Interval

Property Classification	Recurrence Interval 2-Year Without Project	2-Year With Project	5-Year Without Project	5-Year With Project	20-Year Without Project	20-Year With Project	100-Year Without Project	100-Year With Project
Residential	12	0	57	0	542	1	908	1
Commercial	1	0	1	0	37	1	92	1
Public	4	0	7	0	14	0	23	0
Total	17	0	65	0	593	2	1,023	2

Average annual flooding will be reduced from 1,535 acres to 173 acres, a reduction of 89 percent. Reduction in area inundated varies with respect to location within the watershed. The average annual acres inundated in each evaluation reach without and with the project floods is presented in the following tabulation:

Average Annual Area Inundated

Evaluation Reach 1/	Without Project (acres)	With Project (acres)	Reduction (percent)
1	64	8	88
2	265	4	98
3	735	60	92
4	471	101	79
Total	1,535	173	89

1/ Project Map (Appendix D)

The actions of people during time of floods, whether major or minor, cannot be predicted. However, with reasonable precautions, the hazard to life from flood waters will be eliminated. To prevent or minimize future damages, the City will enforce flood plain zoning ordinance(s) (previously discussed) on all areas still subject to flooding from a 100-year frequency flood event (Figure 1).

Sediment originating in the watershed and delivered to the mouth of the watershed will be reduced by the planned five floodwater retarding structures an average of nine acre-feet annually, an 82 percent reduction. Suspended sediment concentration reduction at the mouth of the watershed attributable to the structures will be from 110 milligrams per liter to 30 milligrams per liter.

Water and Air Resources

The structures will effect an estimated net increase in average annual ground water recharge to the Edwards Underground Reservoir of 4,680 acre-feet. It is anticipated this increased recharge can be recovered, within the watershed or immediate vicinity, from wells or by discharge at San Marcos Springs and other smaller springs. This increased recharge will reduce the potential of flow cessation at San Marcos Springs.

Accumulation of sediments and other water-borne deposits in the sediment pools is not expected to significantly decrease the ability of each structure to effect the anticipated ground-water recharge. Soils overlying bedrock within the recharge zone are shallow to non-existent; therefore, not heavy contributors of sediment to the channel systems above the proposed structures. Since the area occupied by the sediment pools of the structures is also limited, the small sediment quantity reaching the pool areas and available to clog the fractured rock will be insignificant during the design life of the structures (100 years). Experience in design and operation of these types of floodwater retarding structures in similar areas over the Edwards Underground Reservoir indicate identical results in this watershed.

The increased recharge to the Edwards Underground Reservoir will result in a reduction of average annual surface runoff from the watershed from 10,539 acre-feet to 5,859 acre-feet, a 44 percent reduction. Consideration was given to present average annual recharge which was estimated to be 8,325 acre-feet. It is expected this initial runoff reduction will be effected throughout the life of the project due to the low sediment accumulation rates and the high permeability of the recharge zone on which the structures are located. Also, due to rapid infiltration of temporarily impounded water into the aquifer, evaporation is not anticipated to be significant.

Installation of the structures will cause a change in the flow regime. During periods of runoff, the depth, velocity, and duration of out-of-channel flows will be reduced downstream from these structures. The duration of the low flows will be increased. This change in flow regime will reduce downstream flooding and associated flood damages.

The structures are designed to store a total of 1,002 acre-feet of sediment during a 100-year period. Quality of water temporarily impounded in each of the sediment pools and entering the aquifer is not expected to be significantly different from similar recharge areas in

the watershed. Presently, there are no pollution problem sources which drain directly into any of the structures. Functioning of the structures should have a slight effect on downstream water quality by reducing sediment concentration in flood waters. The quantity and timing of water passing the structures will be changed slightly. Flood flow into the structures will be detained and released over a longer period of time.

The construction sites are in both rural and urban areas. During construction of the structural works of improvement, air and water pollution will increase slightly from dust and sediment inherent to the construction process. There will be an increase in pollutants such as dust and chemicals from equipment exhausts during these phases. The San Marcos-Hays County Health Department maintains an air quality sample station (No. 45464002) for the Texas Air Control Board. During the project installation period it may be possible to record some increases in suspended particulates and/or gaseous pollutants caused by construction activities. These insignificant increases are local and temporary and not expected to result in long term impacts to the surrounding area. Also, there will be an increase in noise levels as a result of these activities. This increase will be kept within tolerable limits. Noise during construction activities will be a temporary nuisance.

Water Resource Improvement and Recreational Facilities

Installation of the water resource improvement along selected areas of the San Marcos River will protect the unique aquatic ecosystem by limiting access to the stream. The vegetative barrier will be designed to function as a deterrent to the encroachment by picnickers and swimmers to areas that are relatively undisturbed. Encroachment will be limited to the existing recreational developments along the river.

Installation of the recreational facilities will increase the annual number of recreation days available from about 7,730 to 30,160, an increase of 22,430 recreation days. The facilities will include vegetative plantings for screening, wildlife, and beautification. Plantings will be selected and located to provide food and cover for urban wildlife and enhance their habitat. The installation of picnic tables, group shelters, and trails are not expected to have an adverse affect on the terrestrial wildlife species present. The recreational facilities are to be located in areas that have existing access to the river. No additional accesses to the river are planned. Some present accesses will be eliminated by vegetative barriers.

Terrestrial and Aquatic Habitats

Installation of the structures and excavation of borrow sites will remove vegetation and topsoil from 346 acres of oak-juniper habitat. This action will destroy habitat for most species of wildlife. The dams, emergency spillways, and borrow sites will not be revegetated because of the absence of suitable soil material.

There are approximately 60 acres of sediment pools at the lowest ungated outlet that will be left uncleared. This habitat will be periodically flooded for a period of two or three days and will temporarily displace wildlife which utilize the sediment pools. The large oaks are expected to survive the periodic flooding but the smaller trees at lower elevations are not expected to survive.

The habitat value will be reduced because of the frequency, duration, and time of year of flooding. The loss of habitat value is assessed at 50 percent of the 60 acres or the equivalent of 30 acres of habitat loss. When that acreage is combined with 346 acres of cleared area, there is a total of 376 acres of wildlife habitat committed to project.

In addition to the 376 acres, there are approximately 795 acres of habitat in the detention pools that will be totally flooded by the one percent chance storm. The approximate surface area inundated in the five detention pools by selected recurrence intervals is presented in the following tabulation:

2-Year (acres)	5-Year (acres)	20-Year (acres)	100-Year (acres)
151	283	493	795

The above acreages represent maximum and would be reduced by recharge losses and available storage in sediment pools. Inundation of the detention pools will temporarily displace wildlife two to ten days depending upon the volume of the storm runoff and structure characteristics. The effect of the project on this habitat is not significant and any reduced value is expected to be offset by the increase of "edge" habitat and the increased growth of annual weeds in the flood pools.

Another minor effect is the temporary displacement of wildlife due to the construction activities. This will only affect species that tend to avoid human activity and the effects will only be temporary. A specific loss, however, is the destruction of a turkey roost in the sediment pool of Structure No. 2. There are other roosts in the general area that will not be destroyed.

Threatened and Endangered Species

The planned system of five floodwater retarding structures, water resource improvement, and recreational facilities will have no adverse effects on any known populations of endangered or threatened species. The habitat of the Texas blind salamander will benefit by additional aquifer recharge. The structures will indirectly benefit endangered species in the river by increasing the inflow of surface waters into the Edwards Aquifer.

The establishment of a water resource improvement including a vegetative barrier in selected areas along the San Marcos River will help to maintain and protect habitat of the endangered fountain darter, Texas wildrice, and other unique species. Habitat of the San Marcos salamander will not be affected. The Fish and Wildlife Service, Office of Endangered Species, has concurred that no adverse impacts will be occasioned to any Federally listed species. A summary of impacts on endangered and unique species by installation of the planned project is presented in the following tabulation:

SPECIES	FLOODWATER RETARDING STRUCTURES	WATER RESOURCE IMPROVEMENT (VEGETATIVE BARRIERS)	RECREATIONAL FACILITIES
Endangered Species Listed by Fish & Wildlife Service			
Southern Bald Eagle	0	0	0
American Peregrine Falcon	0	0	0
Fountain Darter	+	0	0
Texas Blind Salamander	+	0	0
Texas Wildrice	0	+	* 1/
Other Unique Species or Protected Species by Texas Parks and Wildlife Code (Chapters 67 and 68)			
San Marcos Gambusia	+	0	0
San Marcos Salamander	+	0	0
Golden-cheeked Warbler	0	0	0
Wild Mercury	0	0	0
Basin Bellflower	*	0	0
Romer Euphorbia	0	0	0
Texas Berberis	0	0	0

Beneficial Effect +
Adverse Effect -
No Effect 0
May Effect *

1/ Present recreational activity along the San Marcos River may have an adverse effect on the Texas wildrice. However, installation of the project recreational facilities are not expected to accelerate development along the river but will provide an opportunity for careful and prudent use of the river and protect the Texas wildrice from human encroachment.

Archeological and Historical Resources

There are no known locations of historic significance in the watershed that would be adversely affected by installation of the project. The Cock House, a National Historic Landmark, will benefit from flood damage

reduction. A field survey and evaluation of archeological resources to be affected by the structures were carried out. It was determined that 17 archeological sites may be either inundated or disturbed. Investigations and testing indicated that three of those sites were eligible for nomination to the National Register of Historic Places and mitigation was recommended. SCS archeologists investigated four archeological sites that might be affected by installation of the water resource improvement and recreational facilities. Two of those sites are eligible for nomination to the National Register of Historic Places. However, as a result of those surveys, it was determined that installation of the project would not affect any of the sites; therefore, no further work was anticipated.

Adverse environmental impacts of structural measures on archeological sites will vary with respect to the location of each site within a particular floodwater retarding structure. A summary by location of effects of the floodwater retarding structures on 17 archeological sites is presented in the following tabulation:

Structure Number	Detention Pool	Dam	Emergency Spillway	Borrow Area
1	41HY77	41HY76	41HY76	
	41HY78	41HY75*		
	41HY79			
	41HY80			
	41HY81			
	41HY82			
2	41HY84			
	41HY85			
	41HY86*			
	41HY87			
	41HY88			
	41HY89			
	41HY90			
	41HY91			
3	41HY92*	41HY92*		41HY92*

* Eligible for inclusion in the National Register of Historic Places

Archeological sites in the detention pools will be subject to temporary inundation and possible borrow excavation. Those sites located in the dams and emergency spillways will be disturbed by top soil removal. Similarly, a site located in the auxiliary borrow area will be disturbed by top soil removal.

The recognition, mitigation, and protection, as appropriate, will not only minimize loss of archeological resources affected by installation of the floodwater retarding structures, but also will make a significant contribution to the understanding of primitive man's occupation and use of the Upper San Marcos River area.

Economic and Social

The estimated direct floodwater damages with present level of development that would result from a 100-year frequency flood event will be reduced from $8,259,300 to $255,500, a reduction of 96.9 percent. If the May 1970 flood was to occur with present conditions, monetary damages would be reduced from an estimated $7,717,760 to $238,430, a reduction of 96.9 percent.

Direct monetary floodwater damages, determined for each evaluation reach by recurrence intervals, are presented in the following:

Direct Monetary Floodwater Damages

Evaluation Reach 1/	Recurrence Interval: 2-Year Without Project	2-Year With Project	5-Year Without Project	5-Year With Project	20-Year Without Project	20-Year With Project	100-Year Without Project	100-Year With Project
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
1	690	40	1,530	150	2,610	570	3,130	1,340
2	131,780	0	554,010	0	3,446,870	144,530	8,231,600	243,490
3	6,010	330	8,360	1,310	11,760	4,560	14,180	5,870
4	2,660	1,080	4,330	1,610	7,190	3,030	10,390	4,800
Total	141,140	1,450	568,230	3,070	3,468,430	152,690	8,259,300	255,500

1/ Project Map (Appendix D)

The estimated average annual direct and indirect monetary floodwater damages will be reduced from $879,660 to $27,940, a reduction of 96.8 percent. The total flood damage reduction benefits will be $851,720.

Reduction in monetary flood damages varies with respect to locations within the watershed. Average annual damages and benefits attributed to structural measures are presented in the following:

Evaluation Reach 1/	Average Annual Damages and Benefits: Without Project (dollars)	With Project (dollars)	Benefits (dollars)
1	1,140	150	990
2	857,200	24,870	832,330
3	13,740	1,300	12,440
4	7,580	1,620	5,960
Total	879,660	27,940	851,720

1/ Project Map (Appendix D)

Average annual flood damage reduction with the project is presented in the following:

Evaluation Reach 1/	Average Annual Damage Reduction in Percent: Crop and Pasture	Other Agricultural	Non-Agricultural	Total
1	90.0	86.2	0	86.8
2	0	0	97.1	97.1
3	90.4	90.8	0	90.5
4	77.8	80.9	0	78.6
Total	85.8	87.5	97.1	96.8

1/ Project Map (Appendix D)

Installation of the recreational facilities will provide about $56,300 in average annual benefits.

Increased economic activity will create the equivalent of two permanent jobs. The reduction of damages will provide a higher quality of living and social upgrading.

Installation of the structural measures will stimulate the local economy. Construction will create approximately 266 man-years of employment. The equivalent of one permanent job will be necessary for operation and maintenance of the planned recreational facilities.

When the project is complete, increased agricultural efficiency will be realized by operators of land that will become productive after damaging floods have been reduced. Elimination or reduction of flooding will allow owners of residential and business units to upgrade their properties.

It is estimated that the project will produce local external economies averaging $6,540 annually. These benefits to the local area resulting from the project will include the additional requirements of plant materials, repair services, equipment, and other agricultural supplies and services. New fencing will be required for proper management of pastures and hay meadows. External economies from a national viewpoint were not considered pertinent to the economic evaluation.

Additional intangible benefits will accrue to the project through the opportunity to shift funds from the repair of flood damages to investment in schools and other public facilities that improve the quality of living. In a similar manner, private funds now going to repair flood damage can be shifted to raising the standard of living of the residents in the affected area.

Intangible benefits include a reduction of injury and loss of life and a reduction of health hazards associated with floods. The safety hazard at low water crossings will be reduced substantially.

Favorable Environmental Impacts

1. Owners and operators of 17 farms and ranches will benefit from an 87 percent reduction in average annual flooding, from 1,270 acres to 169 acres.
2. Expenses and inconveniences associated with interruption or delay of travel will be reduced.
3. Flood reduction will be provided to 908 residential properties, 92 business establishments, and 23 public buildings.
4. Recreation days will increase by 22,430 annually.
5. Suspended sediment at the mouth of the watershed will be reduced 73 percent, from 110 milligrams per liter to 30 milligrams per liter.
6. The Edwards Underground Reservoir will be recharged by an additional 4,680 acre-feet annually.
7. Wildlife in the watershed will be affected as follows:
   a. Unique aquatic habitats along the San Marcos River will be protected from human encroachment.
   b. Fauna living in the subterranean ecosystem of the Edwards Aquifer will be benefited.

8. Endangered species in the watershed will be affected as follows:
   a. Aquatic habitat of the endangered fountain darter, Texas wildrice, and other unique species will be afforded protection.
   b. The habitat of the endangered Texas blind salamander will be benefited.
   c. Unique habitat of the San Marcos salamander will not be affected.
9. Increased economic activity will create the equivalent of two permanent jobs for local residents. Construction of the structural measures will create approximately 266 man-years of employment.
10. Public and private funds presently used to repair flood damages can be shifted to more permanent investments that improve the quality of living.
11. Injury, loss of life, and health hazards associated with floods will be reduced.
12. Provide flood damage reduction benefits to the Cock House, a National Historic Landmark.

Adverse Environmental Effects

1. Dust, sediment, and noise pollution will increase during construction.
2. Seventeen archeological sites, three of which are considered eligible for nomination to the National Register of Historic Places, will be affected by construction or inundation.
3. Wildlife habitat in the watershed will be adversely affected as follows:
   a. Installation of the five floodwater retarding structures will destroy, alter, or inundate approximately 2.9 miles of natural stream channel, all of which have ephemeral flow.
   b. Wildlife upland habitat on 346 acres will be destroyed for construction and proper functioning of the five floodwater retarding structures.
   c. Habitat value will be reduced on the remaining 60 acres that will be left uncleared in the sediment pools.
   d. Inundate a maximum of 795 acres of upland habitat in the detention pools.
   e. Destroy one turkey roost located in the sediment pool of Structure No. 2.

ALTERNATIVES

Alternatives considered during the formulation of the selected plan were of two basic types; those which would satisfy goals identified by the public for National Economic Development (NED) and Environmental Quality (EQ), and those which would further reduce or eliminate adverse impacts to the environment resulting from anticipated implementation of the selected plan. The identified goals for NED and EQ are described in the PROJECT PURPOSES AND GOALS Section. Adverse impacts resulting from installation of the selected plan are described in the preceeding section.

The USDA constraint of providing protection from the danger or risk to loss of life from a storm having a predicted recurrence interval of once in every 100 years was applied to every alternative considered. Each alternative included flood plain zoning.

The alternatives considered during plan formulation for satisfying identified NED and EQ goals are as follows:

Alternative 1 (NED-EQ Plan)

The formulation of this alternative is possible since no significant conflicts exists between identified NED and EQ goals. This alternative consists of five floodwater retarding structures, a water resource improvement, and recreational facilities. Major environmental impacts (effects) are summarized (relative to NED and EQ) as follows:

a. Annual flood damage reduction - 96.8 percent
b. Habitat losses - 376 acres
c. Total Cost - $5,911,860; Total Annual Benefits - $908,020; Average Annual Net Benefits - $497,200

Alternative 2

This alternative consists of 68,000 feet of levee system for urban protection in San Marcos. There would be no floodwater retarding structures as in the NED-EQ Plan. Water resource improvement and recreational facilities will be included. Major effects of this alternative are as follows:

a. Annual flood damage reduction - 64.9 percent
b. Habitat losses - 156 acres
c. Total Cost - $15,207,480; Total Annual Benefits - $627,300 Average Annual Net Benefits - (-)$421,190

Alternative 3

This alternative consists of channel work on Purgatory and Willow Springs Creeks, a by-pass channel from Sink Creek to the Blanco River, and a floodwater by-pass channel approximately paralleling the San Marcos River from Interstate 35 to the Blanco River confluence. Total amount of channel improvement is approximately 7.6 miles. The water resource improvement and recreational facilities are included. Major effects are as follows:

a. Annual flood damage reduction - 100 percent
b. Habitat Losses - Approximately 276 acres - Urban and Farm Wildlife Habitat
c. Total Cost - $14,290,680; Total Annual Benefits - $935,960; Average Annual Net Benefits - (-)$45,090

Viable alternatives are those which are acceptable to USDA and for which a public body has expressed a capability to implement. Of the alternatives listed above, only Alternative 1 was found to be viable. Alternatives 2 and 3 were found to be unacceptable to USDA because they produced lower net benefits than Alternative 1 and offered no overriding environmental quality or social well-being impacts. Alternative 2 was unacceptable to the Sponsors because it did not meet the NED goal for average annual flood damage reduction. Similarly, Alternative 3 was unacceptable to the Sponsors because of adverse environmental effects on the San Marcos River and its tributaries. Plan selection was made from viable alternatives. Alternative 1 (NED-EQ Plan) is the Selected Plan for the Upper San Marcos River Watershed. A complete description of this alternative and its environmental effects is presented in the sections of this document dealing with PLANNED PROJECT and ENVIRONMENTAL IMPACT.

Several other alternatives were examined to further reduce or minimize adverse effects of the Selected Plan (Alternative 1). The alternatives were: (1) changing the present use of flood plain land to users that is less susceptible to flood damage and (2) foregoing the implementation of a project. A discussion of each alternative follows:

Alternative 4 - This alternative consisted of changing the present use of the land to one that is less susceptible to damage by flooding.

Potential land uses, listed in order from highest to lowest susceptibility to monetary flood damage, are: urban and built-up land, cropland, pastureland, and rangeland. With this alternative, the flood plain would be converted to a green belt and associated parkland. This would require relocation of 908 residential properties, 92 business establishments, and 23 public buildings at an estimated cost of $25,000,000. Relocation of these properties would convert about 900 acres of agricultural land to urban land.

This alternative would significantly reduce the actual monetary damage caused by floodwater. Damages to the transportation system and agricultural properties would continue at about the same rate because it would be impractical to move or relocate these properties out of the flood hazard area.

Alternative 5 - This alternative consisted of foregoing the implementation of a project. Flooding would continue urban and built-up lands, agricultural land, and the transportation systems, at an estimated average annual damage of $879,660.

The need to use 1,700 acres of land for the installation of the structural measures and resultant adverse impacts would be eliminated. The opportunity to realize about 497,200 in average annual net beneficial effects from a national viewpoint would be foregone. In addition, $6,540 in regional external economies would be foregone. An estimated annual recharge of 4,680 acre-feet of water to the Edwards Aquifer would not occur.

SHORT-TERM VS. LONG-TERM USE OF RESOURCES

Most of the land in the watershed is used for agricultural production; however, some significant changes are anticipated in the next 10 to 15 years. The projected land use in the watershed at the end of the project installation period is as follows:

Land Use	Acres	Percent
Cropland	500	0.8
Pastureland and Hayland	1,480	2.4
Rangeland	46,140	76.0
Urban and Built-up*	12,060	19.8
Small Water Areas	60	0.1
Other	540	0.9
Total	60,780	100.0

*Roads, railroads, highways, cemeteries, educational institutions, unincorporated subdivisions, etc.

Agricultural land is being converted to urban and built-up lands and unincorporated subdivisions. The project will have little or no effect on this trend. The conservation land treatment program is flexible for meeting the treatment needs of changing land uses.

The Upper San Marcos River Watershed is one of eight watersheds located in the Guadalupe River Basin on which SCS provided assistance. Five of the projects are being installed, one is completed, one is being planned, and one appears feasible for planning. The total drainage area of the eight watersheds is about 1,150 square miles or about 19 percent of the drainage area of the Guadalupe River Basin. The Upper San Marcos River Watershed has a total drainage area of 95 square miles or about 1.5 percent of the basin.

If the eight SCS-assisted projects were installed, a total of about 70 floodwater retarding structures and 52 miles of channel work would be constructed in the basin. In addition, there are 38 reservoirs either existing or under construction, four of these having individual capacities of 5,000 acre-feet or more.

The long-term cumulative impacts of the project in the Guadalupe River Basin and the region are as follows: (1) The works of improvement will help contribute to conservation, development, and productive use of the soil, water, and related resources; (2) The project will allow the productivity of the resources to be sustained economically and indefinitely; (3) The standard of living of the residents of the region will be improved through added income; and (4) The project will alter the use on land needed for installation of the works of improvement.

The long-term habitability and contribution to the economic well-being of the area will be improved with only minimal detriment to a few features of the existing environment. In total, the natural environment of the area will be benefited over that which would exist in the long-term without project measures.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The project will commit about 1,489 acres (excluding auxiliary borrow areas) of agricultural land to the construction and functioning of the floodwater retarding structures. All of this acreage is rangeland. A total of 160 acres required for dams and spillways will be retired from agricultural production. Flowage easements will be obtained on 88 acres and 36 acres may be needed for auxiliary borrow areas. Installation of the floodwater retarding structures will commit approximately eleven and nine acres of prime farmland (used as rangeland) at Structure Nos. 3 and 5, respectively.

The commitment of labor and material resources for construction of all structural measures will be irretrievable. No other permanent commitment of resources is known to be required for this project.

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

The plan was developed in full consultation and cooperation with all interested agencies and individuals. Prior to initiation of planning, informational meetings were held by local organizations in San Marcos. The initial meeting was held on July 17, 1970. It was recognized at this and subsequent meetings that favorable public opinion toward a watershed project was needed before submitting an application for planning assistance to the Texas State Soil and Water Conservation Board. It was also emphasized at this meeting that under the auspicies of Public Law 566, a watershed project would be a local endeavor with federal assistance.

The Texas State Soil and Water Conservation Board approved the application with a high priority for planning assistance.

The Upper San Marcos River Watershed application for assistance under Public Law 566, as amended, was authorized for planning by the Administrator of the SCS on January 26, 1973. The State Conservationist of the SCS, in his written notification of initiation of work plan development, solicited information and comments from federal, state, and local agencies that might have an interest in the project. Contacts were made with several agencies and individuals during planning to obtain information and assistance during the planning process.

The Fish and Wildlife Service (FWS) and the Texas Parks and Wildlife Department participated in wildlife surveys of the watershed and furnished reports of findings and anticipated project effects. In addition, FWS Office of Endangered Species was consulted and the proposed project has

been reviewed to determine the impacts to the endangered species in accordance with Section 7 of the Endangered Species Act of 1973 (Public Law 93-205). The State Historic Preservation Officer concurred with the findings of archeological surveys and plans for mitigation. The Sponsors provided the Capitol Area Planning Council with notification of intent to apply for assistance involving Federal funds.

Planning activities were closely coordinated with representatives of the U.S. Geological Survey and the Edwards Underground Water District. The Edwards Underground Water District supports the conclusion that no subsurface water quality problems are anticipated from recharge provided by the project. The Environmental Protection Agency (EPA) was consulted and the proposed project has been reviewed to determine the impacts to the Edwards Underground Reservoir in accordance with Section 1424(e) of the Safe Drinking Water Act of 1974 (Public Law 93-523).

Meetings were held by the Sponsors on numerous dates to gain opinions from individuals and inform the general public. Individuals whose land was directly involved with potential structural measures were notified and invited to attend meetings.

Public input for recreation was incorporated in the plan formulation following meetings with city officials, park board members, and the general public.

Newspapers serving the watershed area published articles announcing public meetings and reported information and conclusions resulting from meetings.[1/] In July 1976, a newsletter discussing planning activities to date was sent to nearly 200 residents, Sponsors, and interested groups.

During watershed planning, the City felt it was in the best interest of residents and businesses along Willow Springs Creek to relocate those homes subject to flooding and to improve the hydraulic characteristics of the channel. This was accomplished independently and completed in July 1976. The work was funded from a Community Development Grant. With the selected plan, there will be no significant urban damage along Willow Springs Creek. Therefore, a proposed floodwater retarding structure on Willow Springs Creek was dropped from consideration.

1/ A list of meetings indicating the topics discussed and those in attendance is available for review at the State Office, Soil Conservation Service, W.R. Poage Federal Building, Temple, Texas 76501.

The following Federal agencies are requested to review and submit comments and recommendations:

U.S. Department of the Army
U.S. Department of Commerce
U.S. Department of Health, Education, and Welfare
U.S. Department of the Interior
U.S. Environmental Protection Agency
Federal Power Commission
U.S. Department of Transportation
Advisory Council on Historic Preservation
Office of Equal Opportunity, USDA

The following state and local agencies are requested to review and submit comments and recommendations:

Budget and Planning Office (State Agency designated by Governor and State Clearinghouse)
Capitol Area Planning Council (Regional Clearinghouse)
Alamo Area Council of Governments (Regional Clearinghouse)

Discussion and Disposition of Each Comment on Draft Environmental Impact Statement (EIS)

Not all of the above agencies requested to comment on the Draft EIS submitted comments. Formal comments were not received from the U.S. Department of the Army, U.S. Department of Commerce, Federal Power Commission, and U.S. Department of Transportation. The responding agencies' comments and the disposition of each are as follows:

Federal Agencies

U. S. Department of Health Education and Welfare

Comment: "We have no significant objections to the project. However, the EIS makes a general statement of pesticide application for mosquito control but without reference to consultation with the State. The inclusion of the results of such a consultation with the State would seem appropriate in the final EIS."

Response: The Plan and Draft EIS provides for the application of pesticides in conformance with current laws (both state and federal) regulating their use.

U. S. Department of the Interior

General Comment

Comment: "As described, this project is a cooperative effort and federally assisted watershed plan. As such, the agreement

between the SCS and project sponsors is the only assurance that the project will be installed, operated and maintained according to the terms, conditions, and stipulations provided.

"The Department of the Interior believes that for the EIS to be entirely adequate the following statement should be added to the agreement:

> The sponsors assure that no destruction or degradation of current existing natural resources will be occasioned by project implementation other than those portrayed in the Environmental Impact Statement."

Response: The agreement contained in the Plan sets forth the conditions under which technical and financial assistance will be provided to the Sponsors by the SCS. Further, it provides specific responsibilities to both the Sponsors and the SCS relative to installation, operation, maintenance, and replacement of the components to the Plan. The EIS provides a discussion and list of favorable and adverse effects of the planned project. These anticipated effects have been developed with affected agencies, groups, and individuals. Environmental concerns relative to existing regulations have been addressed and recognized in the Final EIS. Therefore, the SCS will not require the Sponsors to give further assurances in the agreement.

Comment: <u>Specific Comments</u>

"Page P-3, last paragraph - The word "compliment" should be changed to read "complement."

Response: This faux pas has been corrected.

Comment: "Page E-6, first paragraph - It may be desirable to rephrase the third sentence to show that, when the additional 9,300 acres receive adequate conservation treatment, over 87 percent of the agricultural land will then have adequate conservation treatment. (Cross reference with data on page E-46, fourth paragraph)."

Response: Land Treatment is not a component of this project; therefore, the cursory discussion of land treatment in the Plan and EIS is relative to that which would be planned with technical assistance provided by the going program (Public Law 46). The calculated percentage of 87 percent is a projected effect and not discussed in the document With the data provided in both documents, the reader has the opportunity to calculate this percentage.

Comment: "Page E-16, second and third paragraphs - In order to minimize additional habitat losses, the Department believes that

revegetation must be a primary concern during all phases of the project. Accordingly, every effort should be made to set aside top soil during the initial excavation and at the borrow sites. A commitment to this end should be included in the text, rather than the statement in the third paragraph which begins 'If required....'"

Response: It is the policy of the SCS to revegetate, where feasible, all areas on the site denuded during construction. However, it is anticipated all fine-grained plastic soil materials (which includes top-soil from the predominately shallow soils) excavated during construction will be needed for impervious cores in the embankments. This need is effected because of the scarcity or limited volumes of this type of construction material available on or near the floodwater retarding sites. Borrowing operations are expected to extend to, and on most sites, into bedrock to obtain fill material for the embankments. The SCS feels that under these conditions, it is not practical to state specifically that revegetation will be accomplished on denuded areas, but rather as site by site conditions permit. The referenced paragraph has been restructured to impart a stronger commitment to revegetate denuded areas where feasible.

Comment: "Page E-35, Soils - There should be an explanation in this section that would account for the rapid infiltration of impounded water mentioned in the fifth paragraph on page E-52 and the fourth paragraph on page E-57."

Response: A parenthetical phase has been added to the referenced soils description with regard to rapid infiltration rates.

Comment: "Page E-43, Birds - The preliminary draft stated: 'Texas Parks and Wildlife Department information on turkey roosts indicated thate was a roost of approximately 150 birds at the upstream [end] from the proposed structure No. 3.'

"While this statement has now been removed from the document we are still uncertain whether or not this roost will be impacted."

Response: This Fish and Wildlife Service in March 1978 requested the SCS determine the exact nature of impacts on a turkey roost located in the vicinity of Floodwater Retarding Structure No. 3. This roost was previously identified in a survey report by Texas Parks and Wildlife Department The statement appearing in the preliminary EIS was deleted since the roost could not be located or confirmed by SCS biologists. Further, it was reasoned that the roost either no longer exists or does not occur in areas impacted by construction.

Comment: "Page E-48, third paragraph - The Project Map referenced as located in Appendix E is included in Appendix D in our copy of the statement."

Response: This oversight has been corrected. Appendix D is the Project Map.

Comment: "Page E-55, Area Inundated by Selected Recurrence Intervals (table) - The table is adequate for areas inundated on the floodplain. However, environmental impact occurs in the drainage area also, i.e., the areas behind the flood retarding structures. While this is discussed within the DES, we feel a table, similar in design to the one found on page E-55, would be useful for complete evaluation of impacts in the drainage area."

Response: A similar table was prepared for the Draft EIS and presented on E-59. This table presents the approximate surface area inundated in the five detention pools by selected recurrence. We feel this table is adequate.

Comment: "Page E-56, Average Annual Area Inundated (table) - We suggest a footnote stating that repeated flooding within one season increases the average annual area of inundation."

Response: Repeated or recurring flooding more than once annually is accounted for in the tabulation as presented.

Comment: "Page E-57, fourth paragraph - Since the proposed action would result in increased recharge to the Edwards Limestone ground water reservoir, the effects of increased recharge on the baseflow characteristics of the lower reaches of the Upper San Marcos River should be addressed."

Response: The flow regime of the Upper San Marcos River should undergo long-term adjustment due to increased average annual ground water recharge. This adjustment will be related directly to spring flow from San Marcos Springs, which is expected to provide prolonged base flow to the river. On a short term basis, the most obvious effect within the watershed will be the reduction of out-of-bank flood flow.

U. S. Environmental Protection Agency
(Regional Office)

Comment: "We classify your Draft Environmental Impact Statement as LO-1. Specifically, we have no objections to the project as it relates to Environmental Protection Agency's (EPA) legislative mandates. The statement contained sufficient information to evaluate adequately the possible environmental impacts which

could result from project implementation. Our classification will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions, under Section 309 of the Clean Air Act."

Response: Noted.

(Water Supply Branch)

Comment: "We received the draft watershed plan and draft environmental impact statement for the Upper San Marcos River watershed, Texas. The proposed project is a direct federal action and, consequently, does not require review under Section 1424(e) of P. E. 93-523. Nevertheless, we have reviewed the subject draft at your request, and have no comments to offer."

Response: Noted.

Advisory Council on Historic Preservation

Comment: "Pursuant to Section 106 of the National Historic Preservation Act of 1966 (16 USC 470f, as amended, 90 Stat. 1320) Federal agencies must, prior to the approval of the expenditure of any Federal funds or prior to the granting of any license, permit, or other approval for an undertaking, afford the Council an opportunity to comment on the effect of the undertaking upon properties included in or eligible for inclusion in the National Register of Historic Places.

"Until the requirements of Section 106 are met, the Council considers the DES incomplete in its treatment of historical, archeological, architectural and cultural resources. To remedy this deficiency, the Council will provide, in accordance with its 'Procedures for the Protection of Historic and Cultural Properties' (36 CFR Part 800), substantive comments, on the effect of the undertaking on these properties."

Response: In order to comply with Section 106, the Advisory Council on Historic Preservation will be consulted and the SCS will provide the Council an opportunity to review the proposed plan for archeological mitigation.

Office of Equal Opportunity, USDA

Comment: "With the exception of acknowledging, at page E-38, that a substantial proportion of the population of Hays County is Hispanic, no further information regarding the impact of the proposed action upon Hispanic persons in the affected area is given.

"While flood control projects are generally thought to benefit the entire population, such information as it pertains to the minority population should be made explicit if such is the case. If differential impacts will result for minority groups, that information also should be included, especially if the impacts will be adverse.

"Annual SCS program data for Hays County indicates that only 10.8 percent of the minority operators are SCS Cooperators whereas 72.6 percent of the Anglo operators are SCS Cooperators. While this statistic may be unrelated to the proposed actions, it does suggest that further effort to identify the impact of SCS actions upon Hispanic persons is in order. Accordingly, we recommend that SCS assure that adequate treatment of the effects of this proposed action upon minority persons is included in the Final EIS before approval."

Response: Consideration of annual SCS program data for Hays County is not relevant to this project. The planned project will not adversely affect any minority group in the watershed.

State Agencies

Budget and Planning Office

Comment: The Draft Watershed Plan and Environmental Impact Statement for the Upper San Marcos River Watershed, Comal and Hays Counties, Texas, has been reviewed by the Budget and Planning Office and interested State agencies.

Response: Noted.

Texas Department of Water Resources

Comment: "TDWR offers the following review comments:

"1. Analysis of the subject document indicates that the proposed plan was developed in full consultation and cooperation with all interested agencies and individuals. (See pages E-68 through E-70.) On September 22, 1970, the Texas State Soil and Water Conservation Board approved the Upper San Marcos River Watershed application for assistance under Public Law 566, as amended, with a high priority for planning assistance (see page E-69). On January 26, 1973, the Administrator of the Soil Conservation Service authorized planning. (See page E-69.)

"2. Adequate assurances are furnished that all necessary land and water rights and other permits will be obtained. (See pages P-8, 9, and 10.)

"3. Detailed data presented in the subject document indicate a substantial economic benefit-cost ratio of 2.2 to 1.0 (see page P-6) for the structural measures. Also, we note the basic conclusion of the environmental assessment that 'In total, the natural environment of the area will be benefitted over that which would exist in the long term without project measures.' (See page E-68.)

"4. TDWR foresees no conflict between the subject federal watershed project plan, and TDWR's plans, programs, or projects relative to Statewide water resources development pursuant to TDWR's statutory function."

Response: Noted.

Texas Department of Agriculture

Comment: "I have read with great interest the proposed plans for flood control along the San Marcos River and find the plans to be commendable. In reviewing the Environmental Impact Statement prepared by the sponsors of the proposed project, I find no great adverse effects to the environment created by the construction of the flood-retarding structures. The benefits to the environment and residents of the region will, I believe, greatly offset minor adversities resulting from construction of the project."

Response: Noted.

Texas Air Control Board

Comment: "We have no comments on the above cited document. We appreciate the review opportunity and continue to encourage the consideration of environmental air quality factors in water quality management planning."

Response: Noted.

General Land Office

Comment: "We have reviewed the report on 'Upper San Marcos River Watershed, Comal and Hays Counties, Texas' [sic] and we concur with the proposed plans for this project."

Response: Noted.

State Department of Highways and Public Transportation

Comment: "The proposed project includes the construction of floodwater retarding structures to reduce flooding and erosion, and generally will benefit the operation and maintenance of highways in the area. However, it is noted that the existing pipe culvert on F.M. 2439 will be inadequate to handle the anticipated 450 cfs discharge from Site No. 5 causing a section of this road to be flooded possibly for long periods. This problem will be resolved with the sponsors of the Watershed Plan."

Response: The Sponsors have been informed of all crossings affected by this project and have been presented with alternative courses of action at those locations. The involved Sponsor will take the necessary action.

Texas Soil and Water Conservation Board

Comment: "Our involvement with the sponsors and the Soil Conservation Service staff working on this project leads us to believe that the objectives of the sponsors will be satisfied by this work plan and that the project measures called for in the work plan are the best practicable solution to the watershed problems. We urge that all associated with the project from this point forward seek expedient implementation of the plan.

Response: Noted.

Texas Department of Health

Comment: "Our letter of February 23, 1978, to your office included our comments regarding the report's significance to public and environmental health. The more recent version of the report dated April, 1978, appears to contain substantially the same information as the January, 1978 version. Therefore, our earlier comments remain valid and we have no suggestions to offer for changes."

Response: Noted. In their earlier letter, the Texas Department of Health stated, "... it appears that the proposed improvements are in consonance with this Department's policies regarding environmental health matters."

Texas Parks and Wildlife Department

Comment: "In reviewing the document, we noted changes relative to our comments on the preliminary draft environmental impact statement. For this reason, we offer no additional comments."

Response: Noted

Railroad Commission of Texas

Comment: "This plan is associated with oil and gas related activities in the area of current and past oil and gas well drilling. Commission maps reflect the fact that very little drilling has occurred in Hays and Comal Counties, but there have been wells drilled and plugged that are located in the 'flood plain areas [in this watershed?].' The manner in which these wells were completed and/or plugged may need to be reviewed prior to the operation being initiated."

Response: No evidence of oil or gas related activities were encountered during planning investigations. A close inspection of the Commission's map of Hays and Comal Counties reveal no current or past drilling activity in the vicinity of any of the five floodwater retarding structures. The nearest activity appears to be in the flood plain of the Blanco River.

Local Agencies

Capital Area Planning Council

Comment: "CAPCO's Government Applications Review Committee (GARC) and Executive Committee voted that favorable action be given the proposal. Attached are comments regarding the relationship of your project to regional planning policies, procedures, and objectives."

The comments are as follows:

"1. Judge Burnett commented that this is a very good project, but he regrets that it has taken so long to complete. The Commissioners have not yet discussed the maintenance of the structures, but the Judge does not expect the county to purchase any land surrounding the dams. Maintenance will probably be performed by easements.

City of San Marcos - The biggest problem in San Marcos is flooding, and the City is very favorable toward this project. Federal funding for the project is very tentative. The city of San Marcos expressed a need for support in securing funding.

"2. There have been 2 public hearings on the project - one several years ago and one in March, 1978. The only opposition to the project was raised by the Audubon Society at the first public hearing.

"3. CAPCO Open Space Plan and Resource Preservation Program - The San Marcos River was listed in a preliminary report by the CAPCO Resource Preservation Committee as having global significance biologically. There are flora and fauna in the river which occur nowhere else in the world. The watershed plan documents these species and lists no negative effects on them."

Response: Noted.

Comment: "Government Applications Review Committee recommended favorable action. It was noted that Dr. Clark Hubbs (U.T. Biology Dept.), who serves on CAPCO's Natural Areas Technical Advisory Group, is making suggestions to the SCS project staff for additions to the list of species identified in the Environmental Impact Statement. He expects the overall impact to be positive."

Response: Noted.

Dr. Clark Hubbs' comments are as follows:

Comment: "I have seen the Draft Environmental Impact Statement for the Upper San Marcos River Watershed, Comal and Hays Counties, Texas. On balance I feel the project is good and should be approved but comment on details that may result in more effective evaluations.

"It is appropriate to reduce the mass of EIS reports as seems to have occurred with this one. On the other hand the reduction seems to have reduced the biological assessment so much that it is difficult to evaluate the impacts based solely on reading the document....I would suggest that such materials normally be accumulated as appendices available for the persons interested in technical aspects of the EIS and sent out following request for that specific appendix (or several when applicable)...."

Response: An Environmental Assessment of the watershed was prepared by Environmental Sciences of San Marcos and completed in February 1975. This document contained extensive inventories of biological data and was used as the primary reference for recognizing and evaluating impacts of the proposed project. Subsequent studies were also made. This data was used in determining the impacts of the proposed project and evaluating alternatives. Descriptive material that is not central to understanding the impacts presented in the EIS has been

intentionally omitted. Inclusion of Literature Cited as Appendix C allows the reviewer to examine the published data used in developing the Selected Plan. The inclusion of appendices containing support data would not add to the effectiveness of the Final EIS for the decision making process. Rather, the basic data developed during planning may be reviewed by contacting the State Office, Soil Conservation Service, W. R. Poage Federal Building, Temple, Texas, 76501.

Comment: ..."I append a matrix my research group and I produced on the fishes reported to be present by Longley (1975) as amended by our information. This matrix illustrates the problems that would occur with channelization. The results suggest that flood retention would have biologic advantages...."

Response: We appreciate the interest of Dr. Hubbs and will append his matrix to his letter presented in Appendix B.

Comment: "I express some concern about the proposed expansion of park lands on the south bank of the San Marcos just west of I-35. It is possible that increased recreational use of the river will have a negative impact on the biota of the San Marcos Spring Run. It may be that the Texas wild rice is the most fragile component. I endorse your efforts to minimize the contacts with a 'brush screen' but encourage the use of native (and thorny) plants for that purpose."

Response: The SCS has endorsed the increased use of existing parkland by planning recreational facilities only on suitable areas. We have recognized the possibility of adverse impacts that increased use may cause. Therefore, the SCS has taken every precaution to insure the planned facilities are harmonious to this fragile ecosystem while allowing orderly development of the resource. The Final EIS has been amended to include the use of native vegetation (where applicable) to protect unique habitat from human encroachment.

Comment: "I wonder whether the discussion of alternatives could be enhanced by organization into groups of actions. I envision 3 major categories (1) no construction with subsets of flood plain insurance, removal of present structures, etc. (2) redirection of flow with subsets of channels and/or levees to direct the water to chosen spots and (3) delay of downstream flow. You have chosen the third possibility but we see only one possible version. It is possible that a 6 (or 4 to 7, etc.) impoundment program would have special merit. I would feel that this approach could mean a choice of one (or a combination of) alternative and then maximize the discussions of subsets of that major type of action."

Response: The organization of alternatives presented in the Draft EIS were divided into two major categories. The first category was consistent with the planning objectives expressed in the Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources." "Principles" provide the broad framework for planning activities and include the conceptual basis for planning. "Standards" provide for uniformity and consistency in comparing, measuring, and judging beneficial and adverse effects of alternative plans.

The second category of alternatives were developed to further reduce or eliminate adverse impacts to the environment resulting from the anticipated implementation of the selected plan. Formulation of these alternatives is consistent with the philosophy expressed in the National Environmental Policy Act and SCS administrative policy.

SCS involvement in planning this watershed mandates the USDA constraint in urban areas of providing protection from the danger or risk of loss of life from a 100-year frequency flood. If several smaller structures were constructed on tributaries, a large structure would still be necessary on the major water courses (Sink and Purgatory Creeks) to provide the required level of urban protection.

Investigations during planning activities indicate the planned system of five floodwater retarding structures is the most engineeringly feasible and environmentally sound of all structural alternatives considered. Further, it is our intent to provide a formulated plan that is acceptable to the Sponsors with the least cost.

Alamo Area Council of Governments

Comment: "In order for the structural solution envisioned in this project to be effective to their respective design capabilities, nonstructural management soltuions should be incorporated both upstream and downstream from the projects.

"Nonstructural practices can be very effective in the control of excessive run-off and sedimentation upstream of the projects. Excessive sedimentation will reduce the life of the project and aggravate undesirable encroachment of sediment into the restricted floodplain area downstream."

Response: It is assumed "nonstructural management solutions" is in reference to establishment or enhancement of vegetation providing protection from soil erosion. It is the policy of

the SCS to vegetate construction and disturbed areas when feasible. However, the embankments and excavated areas of the floodwater retarding structures will be covered with or extended into durable limestone rock; therefore, the feasibility and need for vegetative measures resulting from construction operations are anticipated to be quite limited.

Runoff and potentially excessive sedimentation are always prime considerations in the location and design of PL 566 floodwater retarding structures. This is necessary to insure proper functioning during the project life. Adequate protection from soil erosion on at least 75 percent of the drainage area above a floodwater retarding structure is a policy requirement before construction of the structure can begin. Also, storage capacity for sediment expected to accumulate during the life of the project is incorporated into the design of all floodwater retarding structures.

Comment: "The authority to accomplish this task is vested locally in City and County governments in Texas through the provisons of the National Flood Insurance Program. While both Comal County and the City of San Marcos are active participants in the program, and are striving to prevent undesirable development in floodplain areas, Hays County is not now participating.

"The irony of this situation is that even with the flood control facilities in place, there is no assurance that present and future residences, businesses, and other structures will ultimately be protected to the levels projected in the draft Environmental Assessment [Statement?]."

Response: The levels of protection presented in the Plan and EIS represent a specific flood control level regardless of existing ordinances, land use regulations, etc. As previously discussed, SCS involvement in planning a urban watershed mandates the USDA constraint of providing protection from the danger or risk of loss of life from the one percent chance storm. Further, to insure the continued integrity of the planned measures, construction of the five floodwater retarding structures is contigent on continued enforcement of existing flood plain regulations by the City and annual notification of owners and occupants of flood plain property by the City. The City and County will publicize annually the nature and extent of the remaining flood hazards in those areas subject to flooding. See P-9 in Plan.

Comment: "We recommend that these concerns be included in the final Environmental Statement as well as a statement encouraging Hays County to participate in the National Flood Insurance Program."

Response: The SCS, along with other governmental agencies, has encouraged Hays County to participate in the National Flood Insurance Program. At the present time, however, Hays County has not elected to participate in the program.

APPENDICES

APPENDIX A

Display Accounts for Selected Alternative

Selected Plan

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Upper San Marcos River Watershed, Texas

Components	Measures of effects (Average Annual) 1/ 2/
Beneficial effects:	
A. The value to users of increased outputs of goods and services	
1. Flood prevention	$851,720
2. Recreation	56,300
Total beneficial effects	$908,020
Net beneficial effects	$497,200

Components	Measures of effects (Average Annual) 1/ 2/
Adverse effects:	
A. The value of resources required for a plan	
1. Five floodwater retarding structures, recreational facilities, and water resource improvement	
a. Project installation	$355,470
b. Project administration	36,840
c. Operation, maintenance, and replacement	18,510
Total adverse effects	$410,820

1/ 100-years at 6.625 percent interest
2/ Price base: July 1976 current normalized prices for agricultural, 1976 prices for all other.

Selected Plan

ENVIRONMENTAL QUALITY ACCOUNT

Upper San Marcos River Watershed, Texas

Components	Measures of effects
Beneficial adverse effects:	
A. Areas of natural beauty.	1. Destroy rangeland vegetation on 346 acres.
	2. Visual quality will be modified by floodwater retarding structures and use thereof.
B. Quality considerations of water, land, and air resources.	1. Reduce suspended sediment concentration carried by runoff water leaving the watershed from 110 milligrams per liter to 30 milligrams per liter.
	2. Recharge the Edwards Underground Reservoir by 4,680 acre-feet annually. This will result in a reduction from 10,539 to 5,859 acre-feet (44 percent) in average annual volume of watershed runoff.
	3. Modify land use on 346 acres where floodwater retarding structures will require clearing.
C. Biological resources and selected ecosystems	1. Benefit subterranean ecosystem by increasing aquifer recharge.
	2. Protect unique aquatic habitats along San Marcos River.
	3. Destroy wildlife habitat and food supply on the equivalent of 376 acres.

Selected Plan

ENVIRONMENTAL QUALITY ACCOUNT - continued-2

Upper San Marcos River Watershed, Texas

Components	Measures of effects
D. Geological, archeological, and historical resources.	1. Occasionally inundate 15 archeological sites located in the detention pools.
	2. Disturb three archeological sites located in the dam, emergency spillway, and borrow areas.
E. Irreversible or irretrievable commitments.	1. Commit 1,489 acres of rangeland to construction and functioning of floodwater retarding structures.
	2. Commit labor, materials, and energy for construction of measures.

Selected Plan

REGIONAL DEVELOPMENT ACCOUNT

Upper San Marcos River Watershed, Texas

Components	Measures of effects: Region 1/ (Average Annual)	Measures of effects: Rest of Nation (Average Annual) 2/3/
A. Income:		
Beneficial effects:		
1. The value of increased output of goods and services to users residing in the region		
a. Flood prevention	$851,720	0
b. Recreational	56,300	0
c. External Economies	6,540	0
Total beneficial effects	$914,560	0

Components	Measures of effects: Region 1/ (Average Annual)	Measures of effects: Rest of Nation (Average Annual) 2/3/
A. Income		
Adverse effects:		
1. The value of resources contributed from within the region to achieve the outputs		
a. Five floodwater retarding structures, recreational facilities and water resource improvement		
Project installation	$ 94,400	$261,070
Project administration	1,250	35,590
Operation, Maintenance, and Replacement	18,510	0
Total adverse effects	$114,160	$296,660
Net beneficial effects	$800,400	(-)$296,660

1/ South Central Region of Texas, as designated in the Texas Interindustry Project, Office of the Governor, Division of Planning Coordination.
2/ 100-years at 6.625 percent interest
3/ Price base: July 1976 current normalized prices for agricultural, 1976 prices for all other.

REGIONAL DEVELOPMENT ACCOUNT (continued-2)

Upper San Marcos River Watershed, Texas

Components	Measures of effects: Region 1/	Measures of effects: Rest of Nation
B. Employment:		
Beneficial effects:		
1. Increase in number and types of jobs.		
a. Permanent employment	2 permanent jobs	---
b. Employment for project construction	266 man-years of employment during the installation period (5 years)	---
Total beneficial effects	2 permanent jobs	---
	266 man-years of employment over the installation period (5 years)	---

Components	Measures of effects: Region 1/	Measures of effects: Rest of Nation
B. Employment:		
Adverse effects:		
1. Decrease in number and types of jobs	0	0
Total adverse effects	0	0
Net beneficial effects	2 permanent jobs	---
	266 man-years of employment over the installation period (5 years)	---

1/ South Central Region of Texas, as designated in the Texas Interindustry Project, Office of the Governor, Division of Planning Coordination.

Selected Plan

REGIONAL DEVELOPMENT ACCOUNT (continued-3)

Upper San Marcos River Watershed, Texas

Components	Measures of effects	
	Region 1/	Rest of Nation
Population Distribution		
Beneficial effects	Create 2 permanent jobs and 266 man-years of employment over the installation period (5 years)	---
Adverse effects	---	---
Regional Economic Base and Stability		
Beneficial effects	Create 2 permanent jobs and 266 man-years of employment over the installation period (5 years). Reduce flood damages on about 936 acres of agricultural flood plain. Reduce flood damages to owners and occupants of about 908 residential properties, 92 commercial establishments, and 23 public buildings.	---
Adverse effects	---	---

1/ South Central Region of Texas, as designated in the Texas Interindustry Project, Office of the Governor, Division of Planning Coordination.

Selected Plan

SOCIAL WELL-BEING ACCOUNT

Upper San Marcos River Watershed, Texas

Components	Measures of effects
Beneficial and adverse effects:	
A. Real Income distribution	1. Create 2 permanent jobs and 266 man-years of employment over the installation period (5 years).
	2. Create regional income benefit of $914,560.
	3. Local costs of $114,160 annually will be borne by the City, Reclamation and Flood Control District, and the County. The percentage of contributions to local costs by income classes is not readily available.
B. Life, health, and safety	1. Provide protection from the 100-year flood event to 907 residential properties, 91 commercial establishments, and 23 public buildings. Future threats of loss of life and displacements during floods will be eliminated with the exception of one multi-family residential property and one tourist-recreation complex. Flooding of low water crossings will be eliminated or greatly reduced.
C. Recreational opportunities	1. Create an additional 22,430 recreational visitor-day activities for local population.

APPENDIX B

Letters of Comment Received on Draft Environmental Impact Statement

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FIRST INTERNATIONAL BUILDING
1201 ELM STREET
DALLAS, TEXAS 75270

April 20, 1978

Mr. George C. Marks
State Conservationist
Soil Conservation Service
P.O. Box 648
Temple, Texas 76501

Dear Mr. Marks:

We have reviewed the Draft Environmental Impact Statement (EIS) on the proposed watershed plan for the Upper San Marcos River Watershed, Comal and Hays Counties, Texas. The plan will provide for watershed protection and flood prevention for the 95 square miles (60,780 acres) of drainage area. The plan will be carried out by the sponsoring local organizations with assistance from the U.S. Soil Conservation Service under the authority of PL 566, 83d Congress, 68 Stat. 666, as amended. During a five-year installation period, the plan proposes accomplishment of land treatment under the ongoing program, continued enforcement of flood plain zoning, and construction of five single-purpose floodwater retarding structures, and water-based public recreational facilities.

We classify your Draft Environmental Impact Statement as LO-1. Specifically, we have no objections to the project as it relates to Environmental Protection Agency's (EPA) legislative mandates. The statement contained sufficient information to evaluate adequately the possible environmental impacts which could result from project implementation. Our classification will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions, under Section 309 of the Clean Air Act.

Definitions of the categories are provided on the enclosure. Our procedure is to categorize the EIS on both the environmental consequences of the proposed action and on the adequacy of the Impact Statement at the draft stage, whenever possible.

We appreciate the opportunity to review the Draft Environmental Impact Statement. Please send our office two copies of the Final Environmental Impact Statement at the same time it is sent to the Office of Federal Activities, U. S. Environmental Protection Agency, Washington, D. C.

Sincerely,

Myron O. Knudson

for Adlene Harrison
Regional Administrator (6A)

Enclosure

ENVIRONMENTAL IMPACT OF THE ACTION

LO - Lack of Objections

EPA has no objections to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER - Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to re-assess these aspects.

EU - Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

ADEQUACY OF THE IMPACT STATEMENT

Category 1 - Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2 - Insufficient Information

EPA believes the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3 - Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement. If a draft statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make a determination.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FIRST INTERNATIONAL BUILDING
1201 ELM STREET
DALLAS, TEXAS 75270

May 22, 1978

Mr. George C. Marks
State Conservationist
P. O. Box 648
Temple, Texas 76501

Dear Mr. Marks:

We received the draft watershed plan and draft environmental impact statement for the Upper San Marcos River watershed, Texas. The proposed project is a direct federal action and, consequently, does not require review under Section 1424(e) of P. E. 93-523. Nevertheless, we have reviewed the subject draft at your request, and have no comments to offer.

We appreciate the opportunity to review this report.

Sincerely,

F. Warren Morris Jr.

for Charles W. Sever
Chief, Water Supply Branch (6AWS)

UNITED STATES DEPARTMENT OF AGRICULTURE
OFFICE OF EQUAL OPPORTUNITY
WASHINGTON, D.C. 20250

MAY 9 1978

In Reply
Refer To: 8140 Supplement 8

SUBJECT : Watershed Plan and Environmental Impact Statement, Upper San Marcos River Watershed, Texas

TO : George C. Marks
State Conservationist

THRU : Verne M. Bathurst, Deputy
Administrator for Management, SCS

We have reviewed the Plan and Draft Environmental Impact Statement with special interest in your assessment of the effects, if any, the proposed actions will have upon minority persons living in or near the project area or otherwise affected by the project. The SCS General Guidelines for Compliance with the National Environmental Policy Act, 7 CFR 605.8 (b)(3) require the EIS to describe impacts of the proposed action in terms of "...social effects, including civil rights impacts on minority groups and low income persons".

With the exception of acknowledging, at page E-38, that a substantial proportion of the population of Hays County is Hispanic, no further information regarding the impact of the proposed action upon Hispanic persons in the affected area is given.

While flood control projects are generally thought to benefit the entire population, such information as it pertains to the minority population should be made explicit if such is the case. If differential impacts will result for minority groups, that information also should be included, especially if the impacts will be adverse.

Annual SCS program data for Hays County indicates that only 10.8 percent of the minority operators are SCS Cooperators whereas 72.6 percent of the Anglo operators are SCS Cooperators. While this statistic may be unrelated to the proposed actions, it does suggest that further effort to identify the impact of SCS actions upon Hispanic persons is in order. Accordingly, we recommend that SCS assure that adequate treatment of the effects of this proposed action upon minority persons is included in the Final EIS before approval.

James Frazier

JAMES FRAZIER
Director

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

PEP ER-78/303

MAY 26 1978

Mr. George C. Marks
State Conservationist
Soil Conservation Service
Department of Agriculture
Post Office Box 648
Temple, Texas 76501

Dear Mr. Marks:

Thank you for your letter of April 4, 1978, requesting our views and comments on the watershed plan and draft environmental impact statement for the Upper San Marcos River Watershed in Comal and Hays Counties, Texas. We have completed our review and have the following comments.

General Comments

As described, this project is a cooperative effort and federally assisted watershed plan. As such, the agreement between the SCS and project sponsors is the only assurance that the project will be installed, operated and maintained according to the terms, conditions, and stipulations provided.

The Department of the Interior believes that for the EIS to be entirely adequate the following statement should be added to the agreement:

> The sponsors assure that no destruction or degradation of current existing natural resources will be occasioned by project implementation other than those portrayed in the Environmental Impact Statement.

Specific Comments

1. Page P-3, last paragraph - The word "compliment" should be changed to read "complement."

2. Page E-6, first paragraph - It may be desirable to rephrase the third sentence to show that, when the additional 9,300 acres receive adequate conservation treatment, over 87 percent of the agricultural land will then have adequate conservation treatment. (Cross reference with data on page E-46, fourth paragraph).

3. Page E-16, second and third paragraphs - In order to minimize additional habitat losses, the Department believes that revegetation must be a primary concern during all phases of the project. Accordingly, every effort should be made to set aside top soil during the initial excavation and at the borrow sites. A commitment to this end should be included in the text, rather than the statement in the third paragraph which begins "If required...."

4. Page E-35, Soils - There should be an explanation in this section that would account for the rapid infiltration of impounded water mentioned in the fifth paragraph on page E-52 and the fourth paragraph on page E-57.

5. Page E-43, Birds - The preliminary draft stated: "Texas Parks and Wildlife Department information on turkey roosts indicated there was a roost of approximately 150 birds at the upstream [end] from the proposed structure No. 3."

While this statement has now been removed from the document we are still uncertain whether or not this roost will be impacted.

6. Page E-48, third paragraph - The Project Map referenced as located in Appendix E is included in Appendix D in our copy of the statement.

7. Page E-55, Area Inundated by Selected Recurrence Intervals (table) - The table is adequate for areas inundated on the floodplain. However, environmental impact occurs in the drainage area also, i.e., the areas behind the flood retarding structures. While this is discussed within the DES, we feel a table, similar in design to the one found on page E-55, would be useful for complete evaluation of impacts in the drainage area.

8. Page E-56, Average Annual Area Inundated (table) - We suggest a footnote stating that repeated flooding within one season increases the average annual area of inundation.

9. Page E-57, fourth paragraph - Since the proposed action would result in increased recharge to the Edwards Limestone ground water reservoir, the effects of increased recharge on the baseflow characteristics of the lower reaches of the Upper San Marcos River should be addressed.

We hope these comments and recommendations will be of assistance.

Sincerely,

Larry E. Meierotto
SECRETARY

Dep'y Assistant

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

May 1, 1978

Mr. George C. Marks
State Conservationist
Soil Conservation Service
P. O. Box 648
Temple, Texas 76501

Dear Mr. Marks:

This is in response to your request of April 4, 1978, for comments on the draft environmental statement (DES) for the Upper San Marcos River Watershed, Comal and Hays Counties, Texas. We have reviewed the DES and note that the undertaking will affect several archeological sites that may be eligible for inclusion in the National Register of Historic Places.

Pursuant to Section 106 of the National Historic Preservation Act of 1966 (16 USC 470f, as amended, 90 Stat. 1320) Federal agencies must, prior to the approval of the expenditure of any Federal funds or prior to the granting of any license, permit, or other approval for an undertaking, afford the Council an opportunity to comment on the effect of the undertaking upon properties included in or eligible for inclusion in the National Register of Historic Places.

Until the requirements of Section 106 are met, the Council considers the DES incomplete in its treatment of historical, archeological, architectural and cultural resources. To remedy this deficiency, the Council will provide, in accordance with its "Procedures for the Protection of Historic and Cultural Properties" (36 CFR Part 800), substantive comments on the effect of the undertaking on these properties. Please call Michael H. Bureman at (303) 234-4946, an FTS number, to assist you in completing this process.

Sincerely yours,

Louis S. Wall
Assistant Director, Office of
Review and Compliance, Denver

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333
TELEPHONE: (404) 633-3311

June 1, 1978

Mr. George C. Marks
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
P. O. Box 648
Temple, Texas 76501

Dear Mr. Marks:

We have reviewed the draft environmental impact statement for Upper San Marcos River Watershed, Comal and Hays Counties, Texas. We are responding on behalf of the Public Health Service.

We have no significant objections to the project. However, the EIS makes a general statement of pesticide application for mosquito control but without reference to consultation with the State. The inclusion of the results of such a consultation with the State would seem appropriate in the final EIS.

Thank you for the opportunity of reviewing this document.

Sincerely yours,

William H. Foege, M.D.
Assistant Surgeon General
Director

TEXAS DEPARTMENT OF WATER RESOURCES
1700 N. Congress Avenue
Austin, Texas

TEXAS WATER DEVELOPMENT BOARD
A. L. Black, Chairman
Robert B. Gilmore, Vice-Chairman
Milton T. Potts
John H. Garrett
George W. McCleskey
Glen E. Roney

Harvey D. Davis
Executive Director

TEXAS WATER COMMISSION
[illegible]

May 2, 1978

Mr. Charles D. Travis, Director
Governor's Budget & Planning Office
700 Executive Office Building
Austin, Texas 78701

SUBJECT: U.S. Department of Agriculture, Soil Conservation Service -- Draft Watershed Plan and Environmental Impact Statement -- Upper San Marcos River Watershed, Comal and Hays Counties, Texas, (April 1978).

Dear Mr. Travis:

In response to your memorandum of April 7, 1978, the Texas Department of Water Resources (TDWR) has reviewed the subject draft document. The document was prepared collectively by the Soil Conservation Service and the following local sponsoring agencies under the authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566), as amended, and pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969 (Public Law 91-190):

1. Upper San Marcos Watershed Reclamation and Flood Control District.

2. Hays County Commissioners Court.

3. City of San Marcos.

4. Comal-Hays-Guadalupe Soil and Water Conservation District.

The proposed federal project at a total estimated cost of $5,911,860, consists of the following major structural measures to be completed within five years:

1. Construction of five floodwater retarding structures, each composed of an earth dam or embankment with a principal spillway and plunge basin, an emergency spillway, a floodwater retarding pool and a sediment pool. (See page P-3.)

2. Installation of public, water-based recreational facilities on San Marcos River on portions of 47 acres of parkland owned and operated by the City of San Marcos. (See page P-4.)

3. Installation of a water resources improvement consisting of two side inlets, earth shaping and planting along selected areas of the San Marcos River for anti-soil erosion and unique aquatic habitat protection. (See page P-4.)

TDWR offers the following review comments:

1. Analysis of the subject document indicates that the proposed plan was developed in full consultation and cooperation with all interested agencies and individuals. (See pages E-68 through E-70.) On September 22, 1970, the Texas State Soil and Water Conservation Board approved the Upper San Marcos River Watershed application for assistance under Public Law 566, as amended, with a high priority for planning assistance (see page E-69). On January 26, 1973, the Administrator of the Soil Conservation Service authorized planning. (See page E-69.)

2. Adequate assurances are furnished that all necessary land and water rights and other permits will be obtained. (See pages P-8, 9,and 10.)

3. Detailed data presented in the subject document indicate a substantial economic benefit-cost ratio of 2.2 to 1.0 (see page P-6) for the structural measures. Also, we note the basic conclusion of the environmental assessment that "In total, the natural environment of the area will be benefitted over that which would exist in the long term without project measures." (See page E-68.)

4. TDWR foresees no conflict between the subject federal watershed project plan, and TDWR's plans, programs, or projects relative to Statewide water resources development pursuant to TDWR's statutory function.

We appreciated the opportunity to review the subject document. Please advise if we can be of further assistance.

Sincerely,

Charles E. Memin

for Harvey Davis
Executive Director

TEXAS DEPARTMENT OF AGRICULTURE
REAGAN V. BROWN, COMMISSIONER / P. O. BOX 12847 / AUSTIN, TEXAS 78711
AN EQUAL OPPORTUNITY EMPLOYER

May 24, 1978

Mr. Ward C. Goessling Jr.
Coordinator, Natural
Resources Section
Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

RE: Environmental Impact Statement
Upper San Marcos River Watershed
Comal and Hays Counties, Texas

Dear Mr. Goessling:

Thank you for the opportunity to review and comment on the Watershed Plan and Environmental Impact Statement, Upper San Marcos River Watershed, Comal and Hays Counties, Texas.

I have read with great interest the proposed plans for flood control along the San Marcos River and find the plans to be commendable. In reviewing the Environmental Impact Statement prepared by the sponsors of the proposed project, I find no great adverse effects to the environment created by the construction of the flood-retarding structures. The benefits to the environment and residents of the region will, I believe, greatly offset minor adversities resulting from construction of the project.

Thank you again for the opportunity to review and comment upon the above referenced plan.

Sincerely yours,

k H. Bowen
irector, Special Programs

TEXAS AIR CONTROL BOARD

8520 SHOAL CREEK BOULEVARD
AUSTIN, TEXAS 78758
512/451-5711

May 5, 1978

Mr. Ward C. Goessling, Jr., Coordinator
Natural Resources Section
Budget and Planning Office
Office of the Governor
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Subject: Watershed Plan and Environmental Impact Statement, Upper San Marcos River Watershed, Comal and Hays Counties, Texas EIS-8-004-001

Dear Mr. Goessling:

We have no comments on the above cited document. We appreciate the review opportunity and continue to encourage the consideration of environmental air quality factors in water quality management planning.

If we can be of further assistance, please contact me.

Sincerely,

Roger R. Wallis, Deputy Director
Standards and Regulations Program

cc: Mr. James Menke, Regional Supervisor, San Antonio
Mr. Eugene Fulton, Regional Supervisor, Waco

General
Land Office
AUSTIN, TEXAS 78701
BOB ARMSTRONG, COMMISSIONER

PLANNING PROGRAM
1700 North Congress Ave.
Austin, Texas 78701

(512) 475-1539

RECEIVED
MAY 11 1978
Budget/Planning

May 10, 1978

Mr. Bill Hamilton
Office of the Governor
Budget and Planning Office
411 West 13th Street
Austin, Texas 78711

RE: WATERSHED PLAN AND ENVIRONMENTAL IMPACT STATEMENT, UPPER SAN MARCOS RIVER WATERSHED, COMAL AND HAYS COUNTIES, TEXAS

Dear Mr. Hamilton:

We have reviewed the report on "Upper San Marcos River Watershed, Comal and Hays Counties, Texas and we concur with the proposed plans for this project.

We appreciate the opportunity to submitt our comments.

Cordially,

A.J. Bishop

A.J. Bishop
Coordinator

AJB:mr

COMMISSION
REAGAN HOUSTON CHAIRMAN
DEWITT C. GREER
CHARLES E. SIMONS

STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
AUSTIN, TEXAS 78701

ENGINEER DIRECTOR
B. L. DEBERRY

April 28, 1978

IN REPLY REFER TO
FILE NO

D8-E 454

Draft Watershed Plan
and Environmental Impact Statement
Comal and Hays Counties

Upper San Marcos River Watershed

Mr. Ward C. Goessling, Jr., Coordinator
Natural Resources Section
Governor's Budget and Planning Office
411 West 13th Street
Austin, Texas 78701

Dear Sir:

Reference is made to your memorandum dated April 7, 1978 transmitting the above captioned draft watershed plan and environmental statement for review and comments.

Reference is also made to our previous letter dated March 3, 1978 commenting on the preliminary watershed plan and EIS.

The Department's comments on the "draft" are the same as those made regarding the "preliminary."

The proposed project includes the construction of floodwater retarding structures to reduce flooding and erosion, and generally will benefit the operation and maintenance of highways in the area. However, it is noted that the existing pipe culvert on F.M. 2439 will be inadequate to handle the anticipated 450 cfs discharge from Site No. 5 causing a section of this road to be flooded possibly for long periods. This problem will be resolved with the sponsors of the Watershed Plan.

Sincerely yours,

B. L. DeBerry
Engineer-Director

By: R L Lewis

R. L. Lewis, Chief Engineer
of Highway Design

TEXAS STATE SOIL AND WATER CONSERVATION BOARD

1009 First National Building
P. O. Box 658
Temple, Texas 76501
Area Code 817, 773-2250

February 23, 1978

RECEIVED
FEB 24 1978
Budget/Planning

Mr. Ward C. Goessling, Jr., Coordinator
Natural Resources Section
Budget and Planning Office
Office ofthe Governor
411 West 13th Street
Austin, Texas 78701

Dear Mr. Goessling:

We have received a copy of a preliminary watershed plan and environmental impact statement for the Upper San Marcos River Watershed in Comal and Hays Counties, Texas.

This agency received the application for assistance on this project on February 7, 1969. Since then we have worked with the sponsors on numerous occasions attempting to ensure that their control objectives would receive federal assistance. The members of the State Soil and Water Conservation Board personally inspected the project area and held an informal public hearing on July 19, 1972, prior to recommending that the Soil Conservation Service develop a work plan. We have also provided state appropriated funds for planning.

Our involvement with the sponsors and the Soil Conservation Service staff working on this project leads us to believe that the objectives of the sponsors will be satisfied by this work plan and that the project measures called for in the work plan are the best practicable solution to the watershed problems. We urge that all associated with the project from this point forward seek expedient implementation of the plan.

Sincerely yours,

A. C. Spencer
Executive Director

ACS/lc

Texas Department of Health

Fratis L. Duff, M.D., Dr.P.H.
Commissioner

Raymond T. Moore, M.D.
Deputy Commissioner

1100 West 49th Street
Austin, Texas 78756
458-7111

May 12, 1978

Mr. Ward C. Goessling, Jr., Coordinator
Natural Resources Section
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

SUBJECT: Comal and Hays Counties, Texas
Upper San Marcos River Watershed Plan
and Environmental Impact Statement

Dear Mr. Goessling:

Watershed and Environmental Impact Statement — Upper San Marcos River Watershed — Comal and Hays Counties, Texas has been reviewed for its public and environmental health implications. The report bears the stamp "Draft" on the cover and is dated April, 1978. This version of the report and the earlier version which was dated January, 1978, are identified on the cover as "U.S. Department of Agriculture, Soil Conservation Service, Temple, Texas."

Our letter of February 23, 1978, to your office included our comments regarding the report's significance to public and environmental health. The more recent version of the report dated April, 1978, appears to contain substantially the same information as the January, 1978 version. Therefore, our earlier comments remain valid and we have no suggestions to offer for changes.

We appreciate the opportunity to review and comment on the April, 1978, version of the Upper San Marcos River Watershed Plan and Environmental Impact Statement.

Sincerely,

G. R. Herzik, Jr., P.E.
Deputy Commissioner for Environmental
and Consumer Health Protection

DLH/cdd

ccs: Bureau of State Health Planning
and Resource Development, TDH
Public Health Region 6, TDH
Public Health Region 9, TDH

TEXAS
PARKS AND WILDLIFE DEPARTMENT

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April 24, 1978

RECEIVED
APR 25 1978
Budget/Planning

Mr. Ward C. Goessling, Jr., Coordinator
Natural Resources Section
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Re: Watershed Plan and Environmental Impact Statement, Upper San Marcos Watershed, Comal and Hays Counties, Texas (EIS-8-004-001)

Dear Mr. Goessling:

This agency has received the referenced document and offers the following comments.

In reviewing the document, we noted changes relative to our comments on the preliminary draft environmental impact statement. For this reason, we offer no additional comments.

Thank you for the opportunity to review this document.

Sincerely,

HENRY B. BURKETT
Executive Director

HBB:MM:lmw

RAILROAD COMMISSION OF TEXAS
OIL AND GAS DIVISION

CK WALLACE, Chairman
N NEWTON, Commissioner
HN H. POERNER, Commissioner

PHILLIP R. RUSSELL
Director, Field Operations

EST O. THOMPSON BUILDING • CAPITOL STATION – P. O. DRAWER 12967 • AUSTIN, TEXAS 78711

April 26,1978

MEMORANDUM TO: Roger Dillon
Chief Accountant

FROM: Phillip R. Russell
Director of Field Operations

SUBJECT: Watershed Plan and Environmental Impact Statement
Upper San Marcos River Watershed, Comal and Hays
Counties, Texas

The attached letters and report were received in this office April 18, 1978 from the Surface Mining and Reclamation Division.

This plan is associated with oil and gas related activities in the area of current and past oil and gas well drilling. Commission maps reflect the fact that very little drilling has occurred in Hays and Comal Counties, but there have been wells drilled and plugged that are located in the "flood plain areas." The manner in which these wells were completed and/or plugged may need to be reviewed prior to the operation being initiated.

Phillip R. Russell
Director of Field Operations

PRR:mz
attachments

CAPCO

611 SOUTH CONGRESS • SUITE 400 • AUSTIN, TEXAS 78704 • (512) PH. 443-7653

SERVING LOCAL GOVERNMENTS IN

BASTROP • BLANCO • BURNET • CALDWELL • FAYETTE • HAYS • LEE • LLANO • TRAVIS • WILLIAMSON COUNT

May 17, 1978

George C. Marks, State Conservationist
Soil Conservation Service
U.S. Department of Agriculture
Post Office Box 648
Temple, Texas 76501

REF: CAPCO Project #8/04/12/023, Draft Watershed Plan for Upper San Marcos River-EIS, Soil Conservation Service-U.S. Department of Agriculture

Dear Mr. Marks:

The above referenced project has been reviewed in compliance with state and federal requirements and in relation to the Capital Area Planning Council's (CAPCO) areawide planning responsibilities.

CAPCO's Government Applications Review Committee (GARC) and Executive Committee voted that favorable action be given the proposal. Attached are comments regarding the relationship of your project to regional planning policies, procedures, and objectives.

Please call if you need any further information concerning your proposal.

Sincerely,

Richard G. Bean
Executive Director

RGB:sb
Enclosure

CAPCO PROJECT NUMBER: 8/04/12/013

APPLICANT: USDA - Soil Conservation Service

PROJECT TITLE: Draft Watershed Plan for Upper San Marcos River - EIS

STAFF COMMENTS:

1. Judge Burnett commented that this is a very good project, but he regrets that it has taken so long to complete. The Commissioners have not yet discussed the maintenance of the structures, but the Judge does not expect the county to purchase any land surrounding the dams. Maintenance will probably be performed by easements.

   City of San Marcos - The biggest problem in San Marcos is flooding, and the City is very favorable toward this project. Federal funding for the project is very tentative. The city of San Marcos expressed a need for support in securing funding.

2. There have been 2 public hearings on the project - one several years ago and one in March, 1978. The only opposition to the project was raised by the Audubon Society at the first public hearing.

3. CAPCO Open Space Plan and Resource Preservation Program - The San Marcos River was listed in a preliminary report by the CAPCO Resource Preservation Committee as having global significance biologically. There are flora and fauna in the river which occur nowhere else in the world. The watershed plan documents these species and lists no negative effects on them.

COMMITTEE COMMENTS/RECOMMENDATIONS:

May 3, 1978 - Government Applications Review Committee recommended favorable action. It was noted that Dr. Clark Hubbs (U.T. Biology Dept.), who serves on CAPCO's Natural Areas Technical Advisory Group, is making suggestions to the SCS project staff for additions to the list of species identified in the Environmental Impact Statement. He expects the overall impact to be positive.

EXECUTIVE COMMITTEE COMMENTS/RECOMMENDATIONS:

FAVORABLE ACTION

DATE: MAY 16, 1978

THE UNIVERSITY OF TEXAS AT AUSTIN
AUSTIN, TEXAS 78712

Department of Zoology

May 10, 1978

George C. Marks
P.O. Box 648
Temple, Texas

Dear Mr. Marks:

I have seen the Draft Environmental Impact Statement for the Upper San Marcos River Watershed, Comal and Hays Counties, Texas. On balance I feel the project is good and should be approved but comment on details that may result in more effective evaluations.

It is appropriate to reduce the mass of EIS reports as seems to have occurred with this one. On the other hand the reduction seems to have reduced the biological assessment so much that it is difficult to evaluate the impacts based solely on reading the document. Mr. McPherson from your staff kindly has provided me with additional material (notably a 1975 report by Glenn Longley) that is sufficient for my immediate needs. I would suggest that such materials normally be accumulated as appendices available for the persons interested in technical aspects of the EIS and sent out following request for that specific appendix (or several when applicable). Such an appendix on fishes could incorporate a modification of a Leopold matrix to aid in the evaluation. I append a matrix my research group and I produced on the fishes reported to be present by Longley (1975) as ammended by our information. This matrix illustrates the problems that would occur with channelization. The results suggest that flood retention would have biologic advantages. Note that this approach also has dangers as reflected by the numerous minus values, suggesting that construction should be carefully monitored. I feel that the biota in the San Marcos River upstream from the Blanco confluence is the most important, unique biological resource in Texas. It has been called the San Marcos Spring Run biota to separate those organisms from San Marcos River downstream inhabitants.

I assume that the hydrological impacts of the project are as follows. The bulk of rainfall runoff will be trapped by the 5 impoundments. The trapped water will (1) evaporate, (2) run downstream, or (3) enter the underground aquifers. It seems likely to me that evaporation will be a minor item and thus of secondary consequence. The downstream run off will be the bulk of the water and the effect of the project will be an extension of the time that Sink and/or Purgatory creeks flow. The magnitude of the time extension will depend upon the amount of water trapped and at times will provide free flowing tributaries to the San Marcos River. The rest of the water will penetrate the soil, some to reemerge in shallow seeps, but hopefully most would

recharge the aquifer that supplies the major springs along the Balconnes Escarpment. Whenever feasible efforts should be made to maximize the deep recharge to benefit the unique aquatic biota in the San Marcos Spring Run. The primary hazard to avoid would be any contamination of the aquifer but I suspect present land use patterns would not be likely to cause such problems.

A reduction in flood magnitude would have a minor impact on the estuarine biota as flood flushing enhances productivity there. It seems likely, however, that most floods that would be reduced in San Marcos would be more extensive geographically and the elimination of that part would not substantially impact estuarine productivity. The absence of flood flow in urban areas of San Marcos would have the substantial benefit to the San Marcos Spring Run biota by reduction of the amount of urban chemical "trash" being washed into the San Marcos. Much information now available shows the San Marcos Spring Run biota is adapted to consistent water regimes. Consistency in a variety of parameters, volume, temperature, chemistry seems most beneficial. That level of consistency is normal for waters emerging from deep aquifers. Although less information is available on ecological needs of the troglobitic fauna in the aquifer, it is likely that insurance of flow (of recharge water from your 5 impoundments) would be of benefit.

I express some concern about the proposed expansion of park lands on the south bank of the San Marcos just west of I-35. It is possible that increased recreational use of the river will have a negative impact on the biota of the San Marcos Spring Run. It may be that the Texas wild rice is the most fragile component. I endorse your efforts to minimize the contacts with a "brush screen" but encourage the use of native (and thorny) plants for that purpose.

I wonder whether the discussion of alternatives could be enhanced by organization into groups of actions. I envision 3 major categories (1) no construction with subsets of flood plain insurance, removal of present structures, etc. (2) redirection of flow with subsets of channels and/or levees to direct the water to chosen spots and (3) delay of downstream flow. You have chosen the third possibility but we see only one possible version. It is possible that a 6 (or 4 or 7, etc.) impoundment program would have special merit. I would feel that this approach could mean a choice of one (or a combination of) alternative and then maximize the discussions of subsets of that major type of action.

Despite the above comments I feel the proposed program has many environmental benefits and I hope it will be activated as soon as possible.

Sincerely,

Clark Hubbs

CH/mp

Estimate of impacts of various flood control alternatives on the fishes known to occur in the San Marcos Spring Run. (1) No construction--but some urban growth (2) Channelization (3) Flood retention (4) Importance (including endemism and recreational activity) (i) = introduced species.

	1	2	3	4	
Lepisosteus oculatus	0	-	0	1	
Lepisosteus osseus	0	-	0	1	
Anguilla rostrata	0	-	0	1	
Dorosoma cepedianum	+	0	0	2	
Astyanax mexicanus	-	--	++	4	i
Carassius auratus	+	+	0	1	i
Cyprinus carpio	+	+	0	2	i
Notemigonus crysoleucas	0	-	0	2	i?
Hybopsis aestivalis	-	--	--	4	
Notropis amabilis	-	--	++	5	
Notropis texanus	0	--	-	3	
Notropis venustus	0	-	0	4	
Notropis lutrensis	0	0	+	5	
Notropis stramineus	0	0	+	2	
Notropis volucellus	0	--	-	2	
Dionda episcopa	-	--	++	5	
Pimephales vigalax	0	-	-	2	
Campostoma anomalum	0	--	0	3	
Ictiobus bubalus	0	-	-	2	
Carpiodes carpio	+	0	-	2	
Moxostoma congestum	-	--	0	4	
Ictalurus punctatus	0	--	+	5	
Ictalurus melas	+	0	0	2	
Ictalurus natalis	0	-	+	3	
Pylodictis olivaris	0	--	-	3	
Noturus gyrinus	-	--	+	4	
Zygonectes notatus	0	-	-	3	
Gambusia geiseri	-	--	++	8	
Gambusia affinis	+	-	0	5	
Gambusia georgei	0	--	+	10	
Poecilia latipinna	+	0	+	2	i
Poecilia formosa	+	0	+	4	i
Micropterus dolomieui	0	--	-	1	i
Micropterus punctulatus	0	--	--	2	
Micropterus treculi	0	--	--	8	
Micropterus salmoides	-	--	+	6	
Lepomis gulosus	0	-	+	3	
Lepomis cyanellus	0	-	+	3	
Lepomis punctatus	0	--	++	3	
Lepomis microlophus	0	--	++	4	i?
Lepomis macrochirus	0	-	+	4	
Lepomis auritus	0	--	0	4	i
Lepomis megalotis	0	-	+	2	
Ambloplites rupestris	0	--	+	3	i
Pomoxis annularis	0	-	-	3	
Percina sciera	0	--	-	4	
Percina caprodes	0	--	-	3	
Percina macrolepida	0	-	-	2	
Etheostoma spectabile	0	--	-	3	
Etheostoma lepidum	0	--	+	3	
Etheostoma fonticola	-	--	++	10	
Cichlasoma cyanoguttatum	+	0	+	2	i
Sarotherodon mossambica	+	0	+	2	i

Totals	+	10	2	31
	-	9	68	19
Adjusted by	+	24	3	141
importance factor	-	30	269	61

alamo area council of governments

June 5, 1978

Mr. George C. Marks
State Conservationist
Soil Conservation Service
United States Department of
Agriculture
P. O. Box 648
Temple, Texas 76501

Re: Draft Watershed Plan for Upper San Marcos River Watershed
(SAI No. 8-06-18-002)

Dear Mr. Marks:

The Alamo Area Council of Governments (AACOG) has conducted a staff review of the above referenced project for watershed protection and flood prevention. It is vital that such a plan be developed and implemented for the protection of valuable rangeland, and most importantly, the protection of human lives.

We would like to offer the following comments for consideration and inclusion in the Final Plan and Environmental Impact Statement:

1. In order for the structural solution envisioned in this project to be effective to their respective design capabilities, nonstructural management solutions should be incorporated both upstream and downstream from the projects.

Nonstructural practices can be very effective in the control of excessive run-off and sedimentation upstream of the projects. Excessive sedimentation will reduce the life of the project and aggravate undesirable encroachment of sediment into the restricted floodplain area downstream.

2. The authority to accomplish this task is vested locally in City and County governments in Texas through the provisions of the National Flood Insurance Program. While both Comal County and the City of San Marcos are active participants in the program, and are striving to prevent undesirable development in floodplain areas, Hays County is not now participating.

The irony of this situation is that even with the flood control facilities in place, there is no assurance that present and future residences,

businesses, and other structures will ultimately be protected to the levels projected in the draft Environmental Assessment.

3. We recommend that these concerns be included in the final Environmental Statement as well as a statement encouraging Hays County to participate in the National Flood Insurance Program.

Thank you for this opportunity to comment on this draft plan and Environmental Impact Statement.

Regionally yours,

Al J. Notzon, III
Executive Director

AJN/MAG/pp

APPENDIX C

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Literature Cited

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APPENDIX D

Project Map